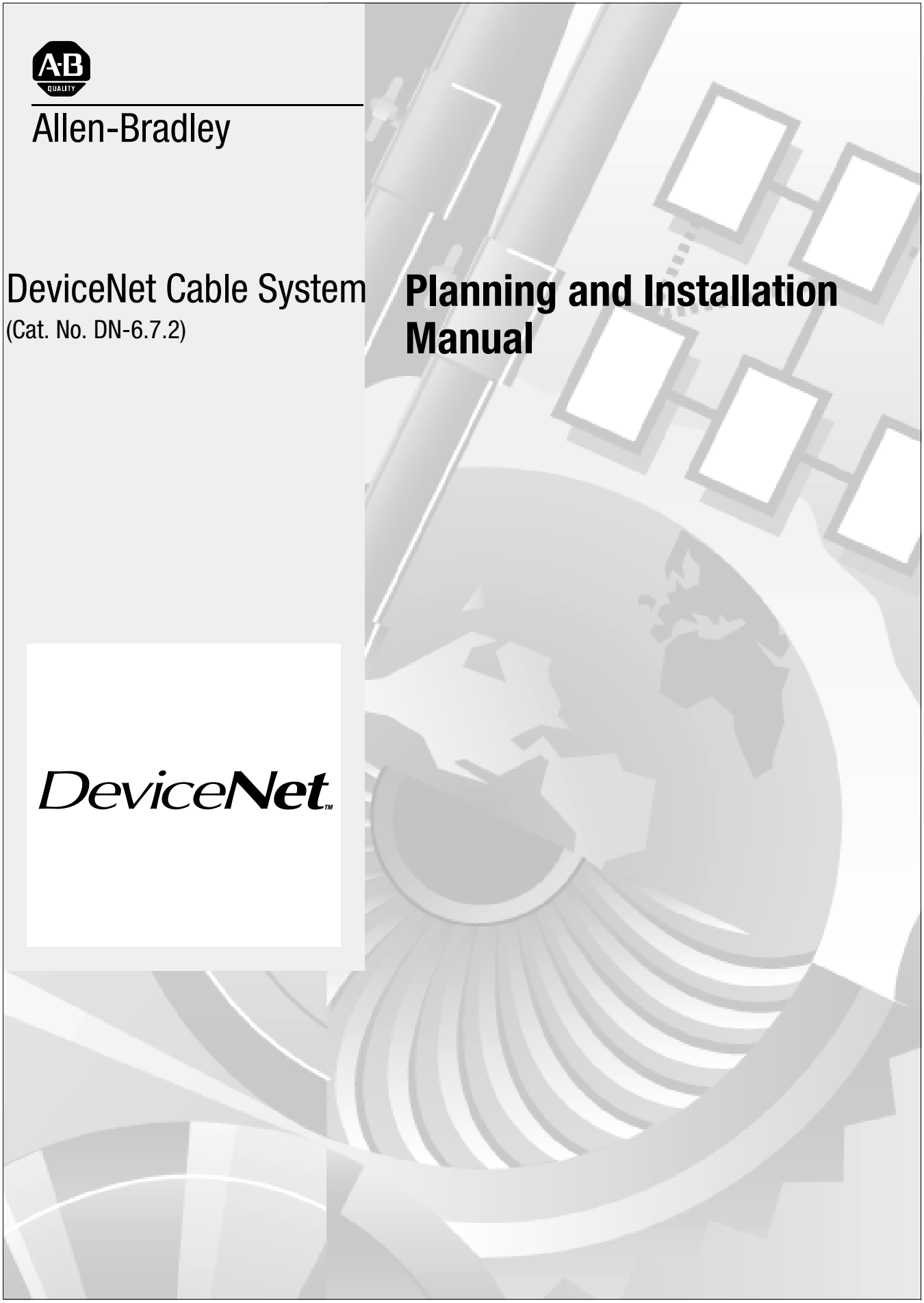

Allen-Bradley

DeviceNet Cable System
(Cat. No. DN-6.7.2)

Planning and Installation Manual

DeviceNet™

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Allen-Bradley, ArmorBlock MaXum and KwikLink are trademarks of Rockwell Automation.

DeviceNet is a trademark of the Open DeviceNet Vendor Association (ODVA).

DeviceBox, DevicePort, and PowerTap are trademarks of Allen-Bradley Company, Inc., a Rockwell International Company.

European Communities (EC) Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — Generic Immunity Standard, Part 2 — Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication "Industrial Automation Wiring and Grounding Guidelines For Noise Immunity," publication 1770-4.1.

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

Introduction

Updated Information

This release of this document contains new and updated information. To help you find the new and updated information, look for change bars, as shown next to this paragraph.

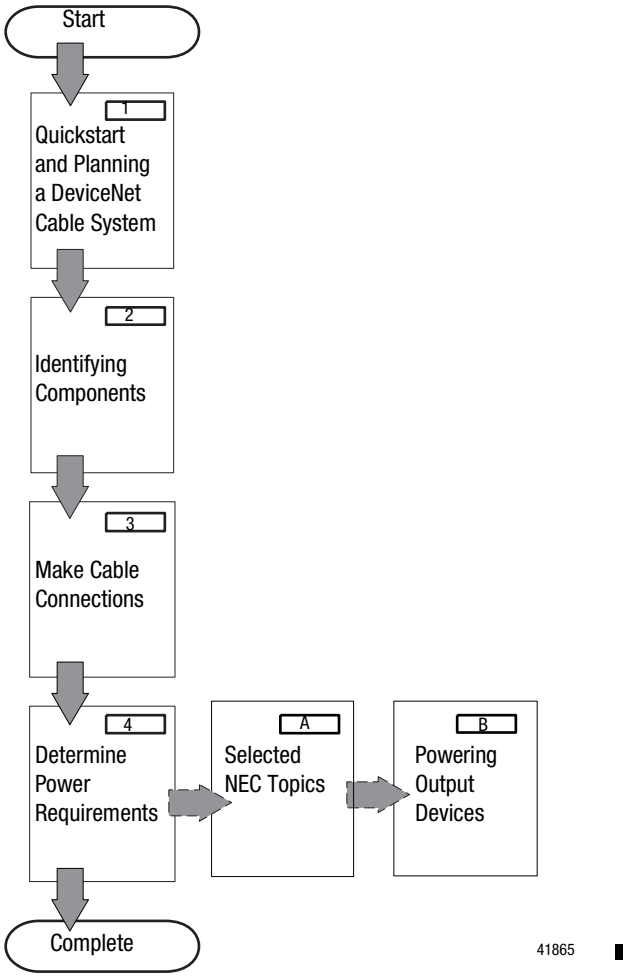
This document has been updated throughout. The most significant changes are:

- the addition of Kwiklink™ flat media cable specifications and installation information
- a reorganization of contents

Using This Manual

What's in This Manual

Use this manual to plan and install a DeviceNet™ cable system. This manual describes the required components of the cable system and how to plan for and install these required components.



Who Should Read This Manual

We assume that you have a fundamental understanding of:

- electronics and electrical codes
- basic wiring techniques
- ac and dc power specifications
- load characteristics of the devices attached to the DeviceNet network

About the Related Publications

Refer to the following publications for more information.

Title	Publication Number
Industrial Automation Wiring and Grounding Guidelines	1770-4.1
DeviceNet Selection Guide	DN-2.15
KwikLink Radiated Immunity Testing	1485-1.1
KwikLink Connection System Brochure	1485-1.0
ArmorBlock MaXum™ I/O Cable Bases	1792D-5.9

About the National Electric Code

Much of the information provided in this manual is representative of the capability of a DeviceNet network and its associated components. The National Electric Code (NEC), in the United States, and the Canadian Electric Code (CECode), in Canada, places limitations on configurations and the maximum allowable power/current that can be provided. Refer to Appendix A for details.

Important: Be sure that all national and local codes are thoroughly researched and adhered to during the planning and installation of your DeviceNet network.

Accessing the Web Sites

You can find out more information about the DeviceNet network by visiting the Allen-Bradley web site at http://www.ab.com/networks.

Common Techniques Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists provide information, not procedural steps.
- Numbered lists provide sequential steps.
- Information in **bold** contained within text identifies menu options, screen names and areas of the screen, such as dialog boxes, status bars, radio buttons and parameters.
- Text in **this font** identifies actions you perform.
- Text in ***this font*** identifies node addresses and other values assigned to devices.
- Pictures of keys and/or screens represent the actual keys you press or the screens you use.

This symbol represents an information tip.

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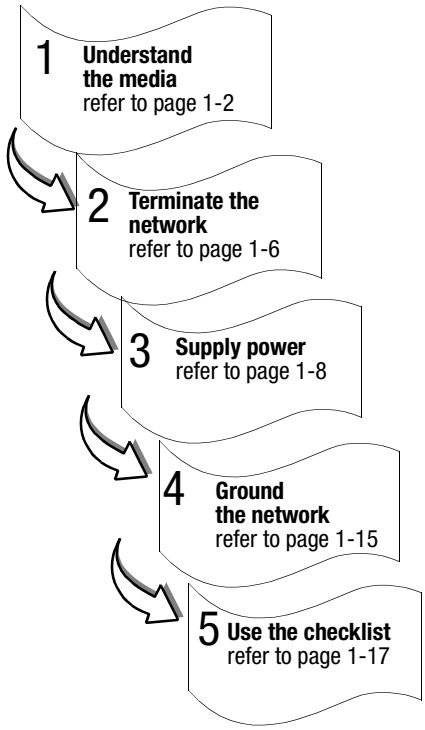
Get Started

What's in This Chapter?

This chapter introduces the DeviceNet cable system and provides a brief overview of how to set up a DeviceNet network efficiently. The steps in this chapter describe the basic tasks involved in setting up a network.

Set Up a DeviceNet Network

The following diagram illustrates the steps that you should follow to plan and install a DeviceNet network. The remainder of this chapter provides an overview and examples of each step, with references to other sections in this manual for more details.



1 Understand the media	Refer to page 1-2
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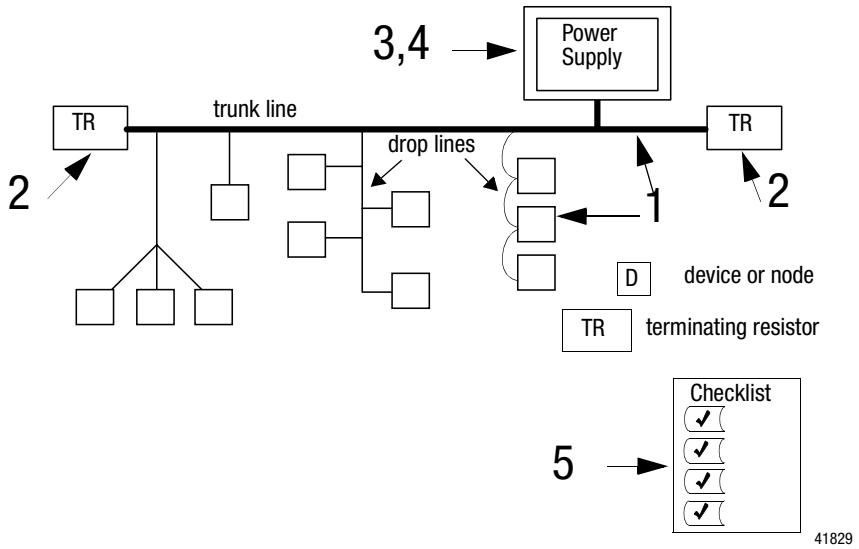
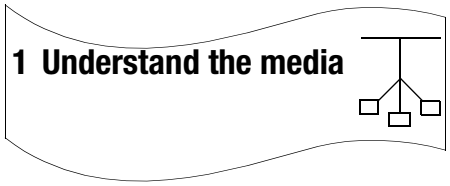
Basic DeviceNet Network

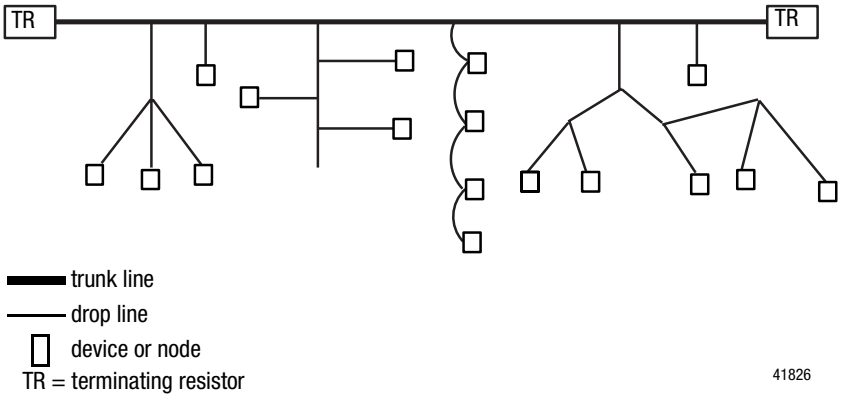
This figure shows a basic DeviceNet network and calls out its basic components.





Understand the Topology

The DeviceNet cable system uses a trunk/drop line topology.



You must terminate the trunk line at both ends with 121 Ohms, 1%, 1/4W terminating resistors.

Understand the Cable Options

All Allen-Bradley media, including KwikLink, meets or exceeds the specifications defined in the ODVA DeviceNet Specification.

You can connect components using three cable options:

Use this cable	For
Round (thick)	The trunk line on the DeviceNet network with an outside diameter of 12.2 mm (0.48 in.). You can also use this cable for drop lines.
Round (thin)	The drop line connecting devices to the main line with an outside diameter of 6.9 mm (0.27 in.). This cable has a smaller diameter and is more flexible than thick cable. You can also use this cable for the trunk line.
Flat • Class 1 power supplies allow for an 8A system and the use of Class 1 flat cable. • Class 2 flat cable must not exceed 4A.	The trunk line on the DeviceNet network, with dimensions of 19.3 mm x 5.3 mm (0.76 in. x 0.21 in.). This cable has no predetermined cord lengths, and you are free to put connections wherever you need them.
KwikLink drop cable	This is a non-shielded, 4 conductor, drop cable for use only in KwikLink systems.

Wire Color	Wire Identity	Usage Round	Usage Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power

Round cable (both thick and thin) contains five wires: One twisted pair (red and black) for 24V dc power, one twisted pair (blue and white) for signal, and a drain wire (bare).

Flat cable contains four wires: One pair (red and black) for 24V dc power; one pair (blue and white) for signal.

Drop cable for KwikLink is a 4-wire unshielded gray cable. It is only used with KwikLink flat cable systems.

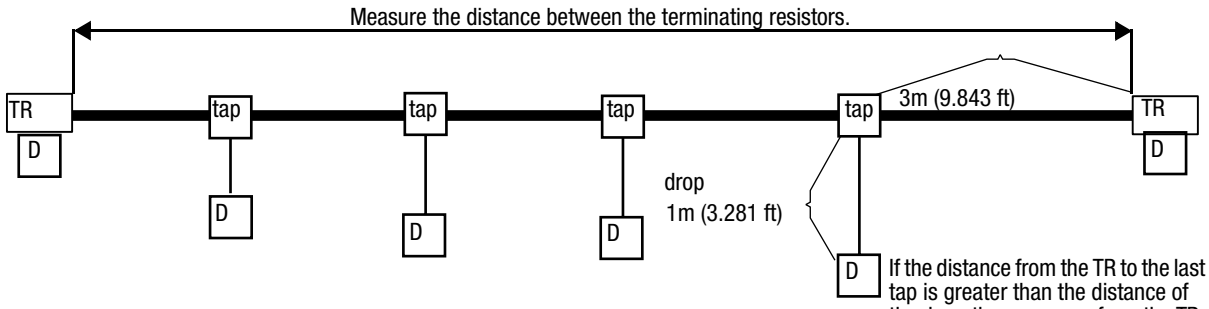
Determine the Maximum Trunk Line Distance

The maximum cable distance is not necessarily the trunk length only. It is the maximum distance between any two devices.

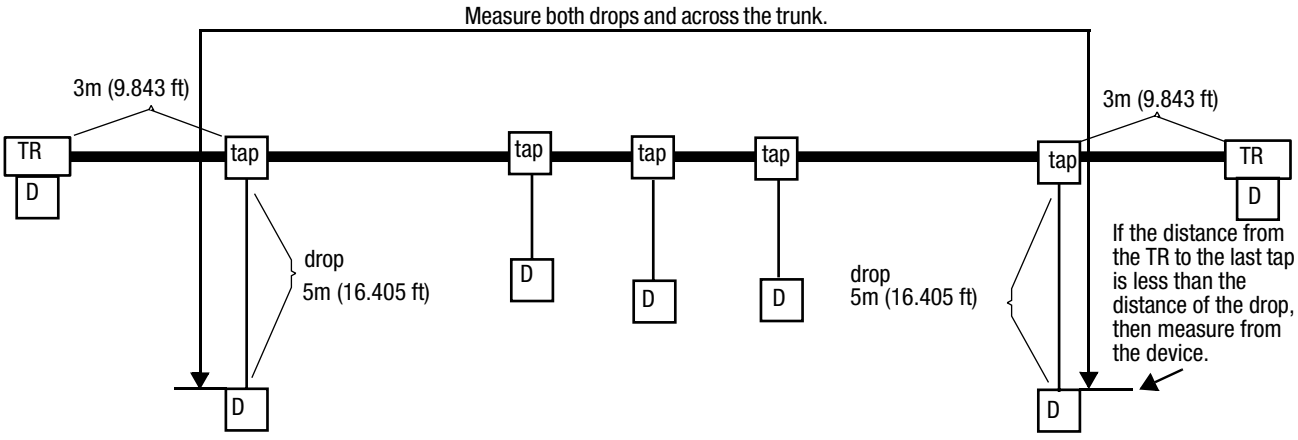
The distance between any two points must not exceed the maximum cable distance allowed for the data rate used.

Data rate	Maximum distance (flat cable)	Maximum distance (thick cable)	Maximum distance (thin cable)
125k bit/s	420m (1378 ft)	500m (1640 ft)	100m (328 ft)
250k bit/s	200m (656 ft)	250m (820 ft)	100m (328 ft)
500k bit/s	75m (246 ft)	100m (328 ft)	100m (328 ft)

For most cases, the maximum distance should be the measurement between terminating resistors. However, if the distance from a trunk line tap to the farthest device connected to the trunk line is greater than the distance from the tap to the nearest terminating resistor (TR), then you must include the drop line length as part of the cable length.



Always use the longest distance between any 2 nodes of the network.



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Determine the Cumulative Drop Line Length

The data rate you choose determines the trunk line and the cumulative length of the drop line.

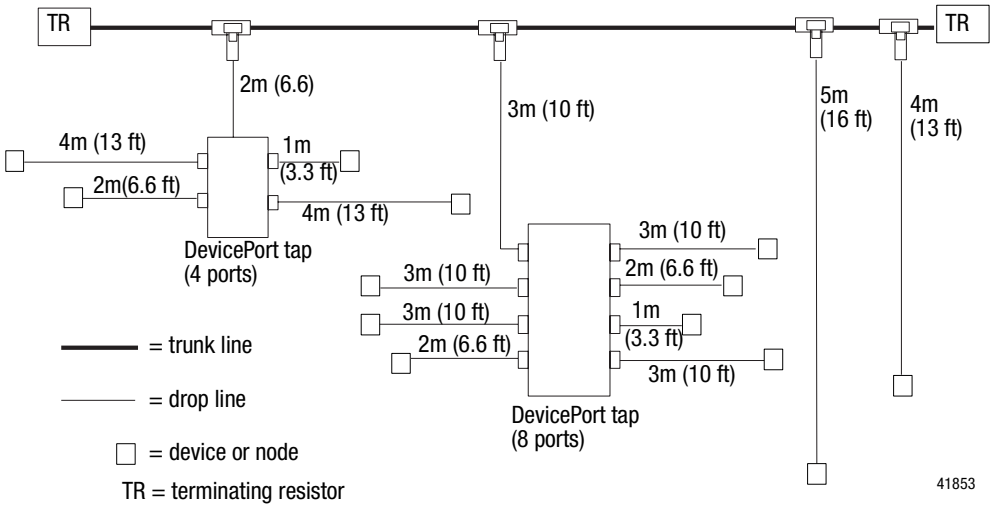
The cumulative drop line length refers to the sum of all drop lines, thick or thin cable, in the cable system. This sum cannot exceed the maximum cumulative length allowed for the data rate used.

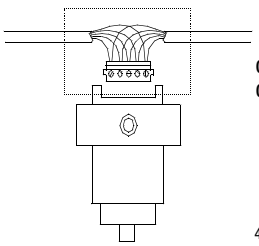
The maximum cable distance from any device on a branching drop line to the trunk line is 6m (20 ft).

Data rate	Cumulative drop line length
125k bit/s	156m (512 ft)
250k bit/s	78m (256 ft)
500k bit/s	39m (128 ft)

The following example uses four T-Port (single-port) taps and two DevicePort™ (multi-port) taps to attach 13 devices to the trunk line. The cumulative drop line length is 42m (139 ft) and no single node is more than 6m (20 ft) from the trunk line. This allows you to use a data rate of 250k bit/s or 125k bit/s. A data rate of 500k bit/s cannot be used in this example because the cumulative drop line length (42m) exceeds the total allowed (39m) for that data rate

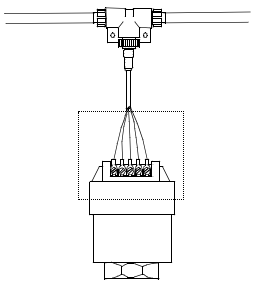
.





About the Direct Connection

Connect devices directly to the trunk line only if you can later remove the devices without disturbing communications on the cable system.This is called a “zero-length” drop, because it adds nothing (zero) when calculating cumulative drop line length.



Important: If a device provides only fixed-terminal blocks for its connection, you must connect it to the cable system by a drop line. Doing this allows you to remove the device at the tap without disturbing communications on the trunk line of the cable system.

Using Connectors

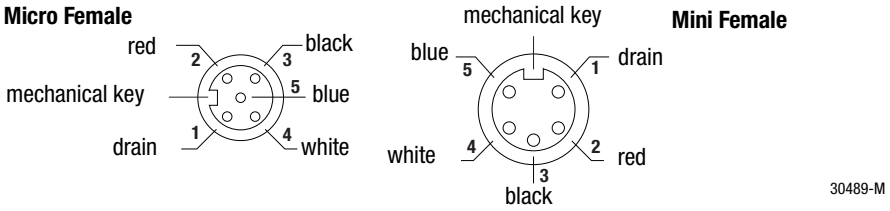
Connectors attach cables to devices or other components of the DeviceNet cable system. Field-installable connections are made with either sealed or open connectors.

Wire Color	Wire Identity	Usage Round	Usage Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power

Connector	Description
Sealed	Mini-style: Attaches to taps and thick and thin cable. Micro-style: Attaches to thin cable only - has a reduced current rating.
Open	Plug-in: Cable wires attach to a removable connector. Fixed: Cable wires attach directly to non-removable screw terminals (or equivalent) on device.

Mini/Micro field-installable quick-disconnect (sealed) connectors (round media only)

Screw terminals connect the cable to the connector.

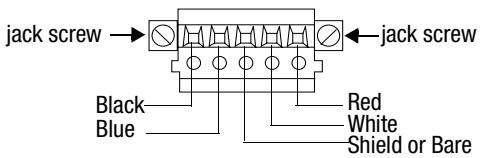


Connector	Thin	Thick
Micro male	871A-TS5-DM1	n/a
Micro female	871A-TS5-D1	n/a
Mini male	871A-TS5-NM1	871A-TS5-NM3
Mini female	871A-TS5-N1	871A-TS5-N3

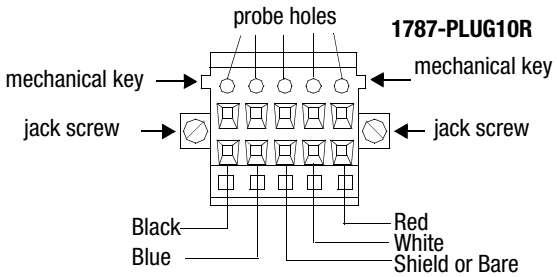
Plug-in field-installable (open) connectors

Most open-style devices ship with an open-style connector included. These connectors are also shipped in packages of 10.

PN 942154-05 (with jack screws)
PN 942153-05 (without jack screws)



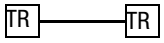
5 pin linear plug (open) 41707



10-pin linear plug (open) 41708

See Chapter 3 for information about making cable connections.

2 Terminate the network



To verify the resistor connection, disconnect power and measure the resistance across the Can_H and Can_L lines (blue and white wires, respectively). This reading should be approximately 50-60 ohms.

Do not put a terminating resistor on a node with a non-removable connector. If you do so, you risk network failure if you remove the node. You must put the resistor at the end of the trunk line.

The terminating resistor reduces reflections of the communication signals on the network. Choose your resistor based on the type of cable (round or flat) and connector (open or sealed) you use.

For round cable:

- the resistor may be sealed when the end node uses a sealed T-port tap
- the resistor may be open when the end node uses an open-style tap

For flat cable:

- the resistor is a snap-on cap for the KwikLink connector base, available in sealed and unsealed versions

You must attach a terminating resistor equal to 120 ohms, 5% or greater or 121 ohms, 1%, 1/4W, to each end of the trunk cable. You must connect these resistors directly across the blue and white wires of the DeviceNet cable.

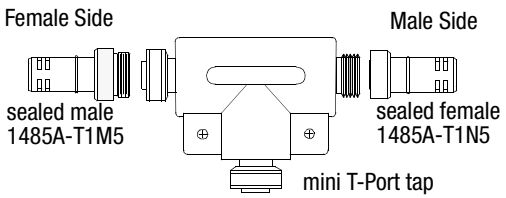
ATTENTION: If you do not use terminating resistors as described, the DeviceNet cable system will **not** operate properly.

The following terminating resistors provide connection to taps and the trunk line.

- sealed-style terminating resistors

Male or female connections attach to:

- trunk line ends
- T-Port taps



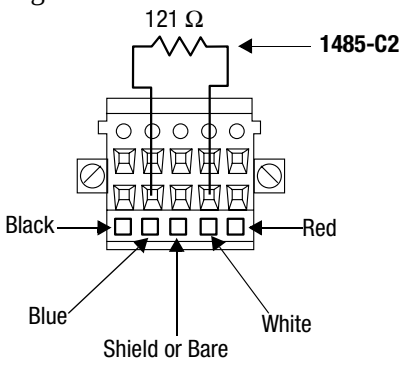
- open-style terminating resistors

121 ohms, 1%, 1/4W resistors connecting the white and blue conductors in micro- or mini-style attach to:

  – open-style T-Port taps

  – trunk lines using terminator blocks

Wire Color	Wire Identity	Usage Round	Usage Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power



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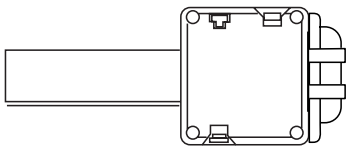
- KwikLink flat cable terminating resistors

The 121 ohm resistor is contained in the snap-on interface module:

  – sealed terminator with an Insulation Displacement Connector (IDC) base (NEMA 6P, 13; IP67) 1485A-T1E4

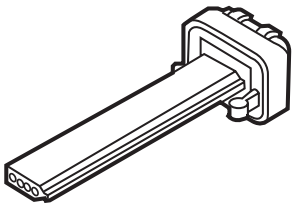
  – unsealed terminator with IDC base (no gaskets) (NEMA 1; IP60) 1485A-T1H4

Network endcaps are included with each KwikLink terminator; see page Page 3-12 for complete installation instructions.



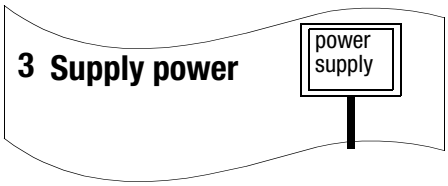
terminating resistor with end cap

30490-M



end cap

30479-M

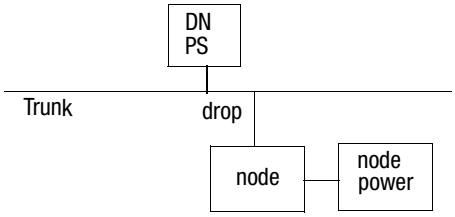


Guidelines for Supplying Power

The cable system requires the power supply to have a rise time of less than 250 milliseconds to within 5% of its rated output voltage. You should verify the following:

- the power supply has its own current limit protection
- fuse protection is provided for each segment of the cable system
  - any section leading away from a power supply must have protection
- the power supply is sized correctly to provide each device with its required power
- derate the supply for temperature using the manufacturer's guidelines

Use the power supply to power the DeviceNet cable system only. If a device requires a separate 24V power source other than the DeviceNet power source, you should use an additional 24V power source.



Important: For thick cable and Class 2 flat cable, your national and local codes may not permit the full use of the power system capacity. For example, **in the United States and Canada, the power supplies that you use with thick cable must be Class 2 listed per the NEC and CECode.** The total current allowable in any section of thick cable must not exceed 4A.

Class 1 power supplies allow for an 8A system, and the use of Class 1 flat cable. See Appendix A for more information about national and local codes.

Choosing a Power Supply

The total of all of the following factors must not exceed 3.25% of the nominal 24V needed for a DeviceNet cable system.

- initial power supply setting - 1.00%
- line regulation - 0.30%
- temperature drift - 0.60% (total)
- time drift - 1.05%
- load regulation - 0.30%

Use a power supply that has current limit protection as per national codes such as NEC, Article 725.

Important: The dc output of all supplies must be isolated from the ac side of the power supply and the power supply case.

If you use a single power supply, add the current requirements of all devices drawing power from the network. This is the minimum name-plate current rating that the power supply should have. We recommend that you use the Allen-Bradley 24V dc power supply (1787-DNPS) to comply with the Open DeviceNet Vendor Association (ODVA) power supply specifications and NEC/CECode Class 2 characteristics (if applicable).

To determine the required power supply current:

1. Add the current requirements of all devices drawing power from the network.
   For example:
   6.3A
2. Add an additional 10% to this total to allow for current surge.
   e.g. 6.3A x 10% = 6.93A
3. Make sure the total of 2 is less than the minimum name-plate current of the power supply you are using.
   e.g. 6.3A < 8A and NEC/CECode

About Power Ratings

Although the round thick cable and Class 1 flat cable are both rated to 8A, the cable system can support a total load of more than 8A. For example, a 16A power supply located somewhere in the middle of the cable system can supply 8A to both sides of the PowerTap™. It can handle very large loads as long as no more than 8A is drawn through any single segment of the trunk line. However, cable resistance may limit your application to less than 8A.

Drop lines, thick or thin, are rated to a maximum of 3A, depending on length. The maximum current decreases as the drop line length increases.

Drop line length	Allowable current
1.5m (5 ft)	3A
2m (6.6 ft)	2A
3m (10 ft)	1.5A
4.5m (15 ft)	1A
6m (20 ft)	0.75A

You may also determine the maximum current in amps (I) by using:

I = 15/L, where L is the drop line length in feet

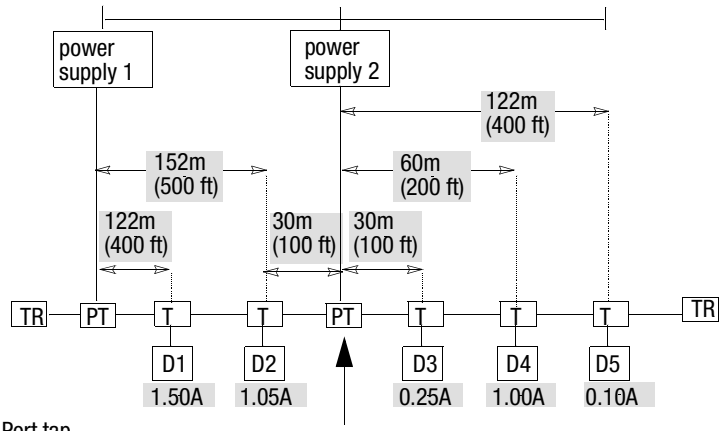
I = 4.57/L, where L is the drop line length in meters

The maximum allowable current applies to the sum of currents for all nodes on the drop line. As shown in the example on page Page 1-3, the drop line length refers to the maximum cable distance from any node to the trunk line, not the cumulative drop line length.

- high maximum common mode voltage drop on the V- and V+ conductors
  - the voltage difference between any two points on the V- conductor must not exceed the maximum common mode voltage of 4.65V
- voltage range between V- and V+ at each node within 11 to 25V

Sizing a Power Supply

Follow the example below to help determine the minimum continuous current rating of a power supply servicing a common section.



TR = terminating resistor T = T-Port tap
PT = PowerTap tap D = device

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Power Supply 1

Add each device's (D1, D2) DeviceNet current draw together for power supply 1 (**1.50+1.05=2.55A**).

Results ⇨ 2.55A is the minimum name-plate current rating that power supply 1 should have. Remember to consider any temperature or environmental derating recommended by the manufacturer.

Important: This derating factor typically does not apply when you consider the maximum short circuit current allowed by the national and local codes.

Power Supply 2

Add each device's (D3, D4, D5) current together for power supply 2 (**0.25+1.00+0.10=1.35A**).

Results

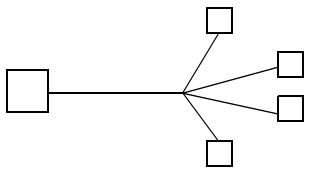
1.35A is the minimum name-plate current rating that power supply 2 should have. Remember to consider any temperature or environmental derating recommended by the manufacturer.

Placing the Power Supply

DeviceNet networks with long trunk lines or with devices on them that draw large currents at a long distance sometimes experience difficulty with common mode voltage. If the voltage on the black V- conductor differs by more than 4.65 volts from one point on the network to another, communication problems can occur. Moreover, if the voltage between the black V- conductor and the red V+ conductor ever falls below 15 volts, then common mode voltage could adversely affect network communication. To work around these difficulties, add an additional power supply or move an existing power supply closer to the heavier current loads.

To determine if you have adequate power for the devices in your cable system, use the look-up method which we describe more fully in Chapter 4. See the following example and figure (other examples follow in Chapter 4). You have enough power if the total load does not exceed the value shown by the curve or the table.

In a worst-case scenario, all of the nodes are together at the opposite end of the power supply, which draws all current over the longest distance.



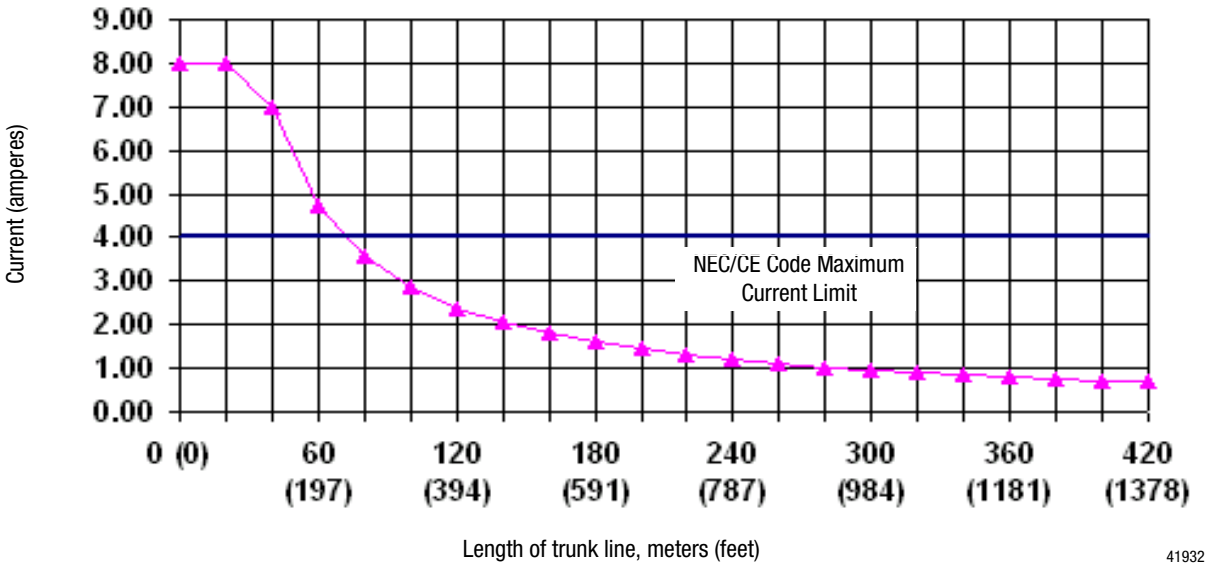
41710

Important: This method may underestimate the capacity of your network by as much as 4 to 1. See Chapter 4 to use the full-calculation method if your supply does not fit under the curve.

A sample curve (reprinted from page 4-4) for a single, end-connected power supply is shown on the next page.

Figure 1.1 One Power Supply (End Segment) KwikLink Cable (Flat)

Important: Assumes all nodes are at the opposite end of the cable from the power supply.

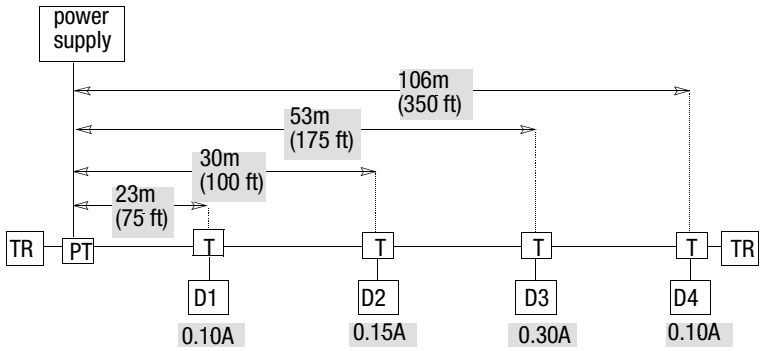


Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*
20 (66)	8.00*
40 (131)	7.01*
60 (197)	4.72*
80 (262)	3.56
100 (328)	2.86
120 (394)	2.39
140 (459)	2.05
160 (525)	1.79
180 (591)	1.60
200 (656)	1.44

Network Length m (ft)	Maximum Current (A)
220 (722)	1.31
240 (787)	1.20
260 (853)	1.11
280 (919)	1.03
300 (984)	0.96
320 (1050)	0.90
340 (1115)	0.85
360 (1181)	0.80
380 (1247)	0.76
400 (1312)	0.72
420 (1378)	0.69

*Exceeds NEC CL2/CECode 4A limit.

The following example uses the look-up method to determine the configuration for one end-connected power supply. One end-connected power supply provides as much as 8A near the power supply.



TR = terminating resistor T = T-Port tap
PT = PowerTap tap D = device

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1. Determine the total length of the network.

– **106m**

2. Add each device's current together to find the total current consumption**.**

– **0.10+0.15+0.30+0.10=0.65A**

Important: Make sure that the required power is less than the rating of the power supply. You may need to derate the supply if it is in an enclosure.

3. Find the next largest network length using the table on page 1-12 to determine the maximum current allowed for the system (approximately).

– **120m (2.47A)**

Result ⇨ Since the total current does not exceed the maximum allowable current, the system will operate properly (0.65A ≤ 2.47A).

Important: If your application doesn't fit "under the curve," you may either:

- Do the full-calculation method described in Chapter 4.
- Move the power supply to somewhere in the middle of the cable system and reevaluate per the previous section.

Connecting Power Supplies

To supply power you will need to install and ground the power supplies. To install a power supply:

Important: Make sure the ac power source remains off during installation.

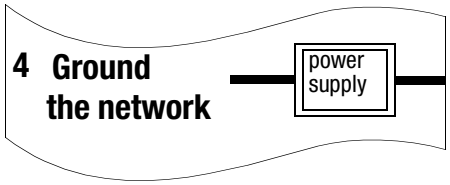
1. Mount the power supply securely allowing for proper ventilation, connection to the ac power source, and protection from environmental conditions according to the specifications for the supply.

2. Connect the power supply using:

   – a cable that has one pair of 12 AWG conductors or the equivalent or two pairs of 15 AWG conductor

   – a maximum cable length of 3m (10 ft) to the power tap

   – the manufacturer's recommendations for connecting the cable to the supply



You must ground the DeviceNet network at only one location. Follow the guidelines described below.

ATTENTION: To prevent ground loops,

- **For Round media** - Ground the V- conductor, shield, and drain wire at **only one** place.
- **For Flat media** - Ground the V- conductor at **only one** place.

Do this at the power supply connection that is closest to the physical center of the network to maximize the performance and minimize the effect of outside noise.

Make this grounding connection using a 25 mm (1 in.) copper braid or a #8 AWG wire up to a maximum 3m (10 ft) in length. If you use more than one power supply, the V- conductor of **only one** power supply should be attached to an earth ground.

If you connect multiple power supplies, V+ should be broken between the power supplies. Each power supply's chassis should be connected to the common earth ground.

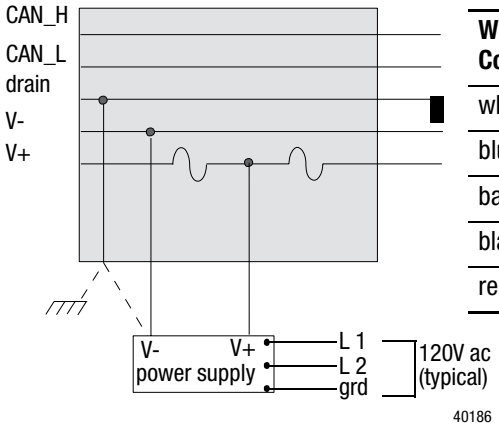
To ground the network:

- Connect the network shield and drain wire to an earth or building ground using a 25 mm (1 in.) copper braid or a #8 AWG wire up to 3m (10 ft) maximum in length.
- Use the same ground for the V- conductor of the cable system and the chassis ground of the power supply. Do this at the power supply.

Important: For a non-isolated device, be certain that additional network grounding does not occur when you mount the device or make external connections to it. Check the device manufacturer's instructions carefully for grounding information.

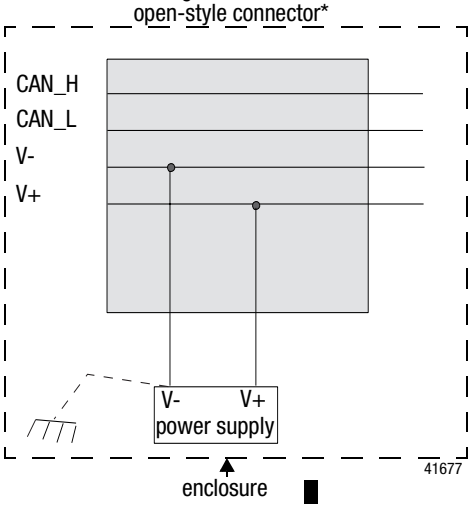
One Power Supply

Round media
wiring terminal block



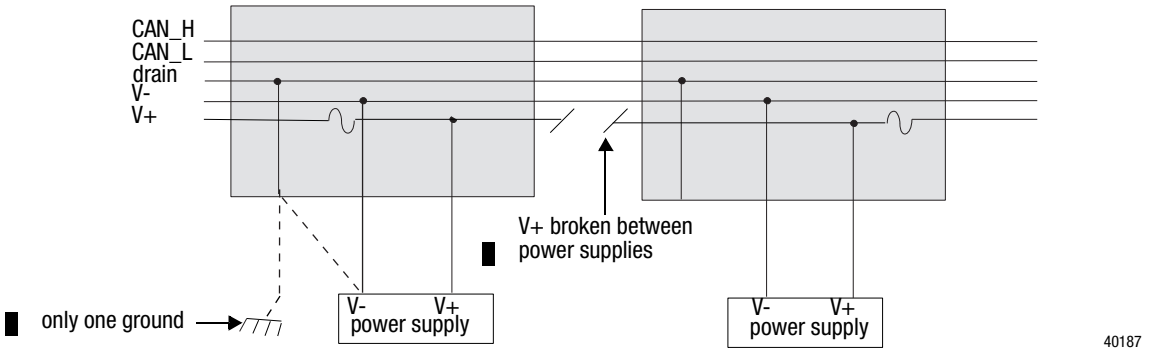
Wire Color	Wire Identity	Usage Round	Usage Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power

Flat media
wiring terminal block
open-style connector*

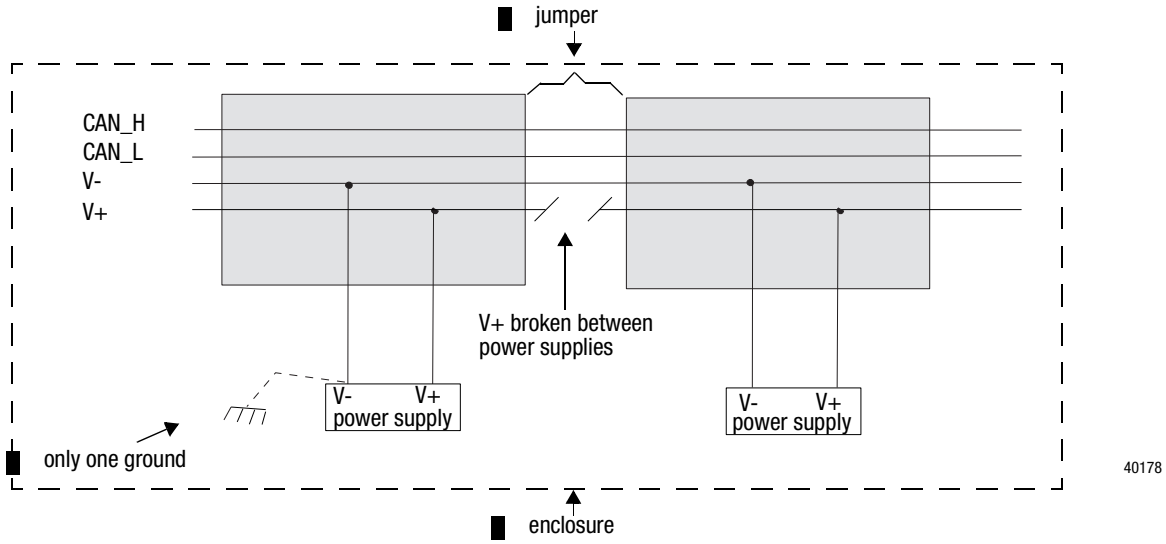


*A micro style connector may be used for power supply connections requiring less than 4A. Use open-style connectors for up to 8A.

Two or more Power Supplies for Round Media



Two or more Power Supplies for Flat Media



5 Use the checklist

Use this checklist when you install the DeviceNet network. You should complete this checklist prior to applying power to your network.

- ❑ Total device network current draw does not exceed power supply current limit.
- ❑ Common mode voltage drop does not exceed limit.
- ❑ Number of DeviceNet nodes does not exceed 64 on one network. The practical limit on DeviceNet nodes may be 61 devices since you should allow one node each for the scanner, the computer interface module, and an open node at node 63.*****
- ❑ No single drop over 6m (20 ft).
- ❑ Cumulative drop line budget does not exceed network baud rate limit.
- ❑ Total network trunk length does not exceed the maximum allowable per the network data rate.
- ❑ Terminating resistors are on each end of the trunk line.
- ❑ Ground, at only **one** location, preferably in the center of the network
  - V- for flat media
  - V- drain and shield for round media
- ❑ All connections are inspected for loose wires or coupling nuts.
- ❑ Check for opens and shorts.
- ❑ Check for proper terminating resistors.
- ❑ Both the programmable controller and DeviceNet scanner module are in run mode.

Important: If your DeviceNet system does not run properly, see the scanner module's display and network and status LEDs for help in troubleshooting. You can also refer to the DeviceNet Troubleshooting Guide, catalog number ABT - N100 - TSJ20.

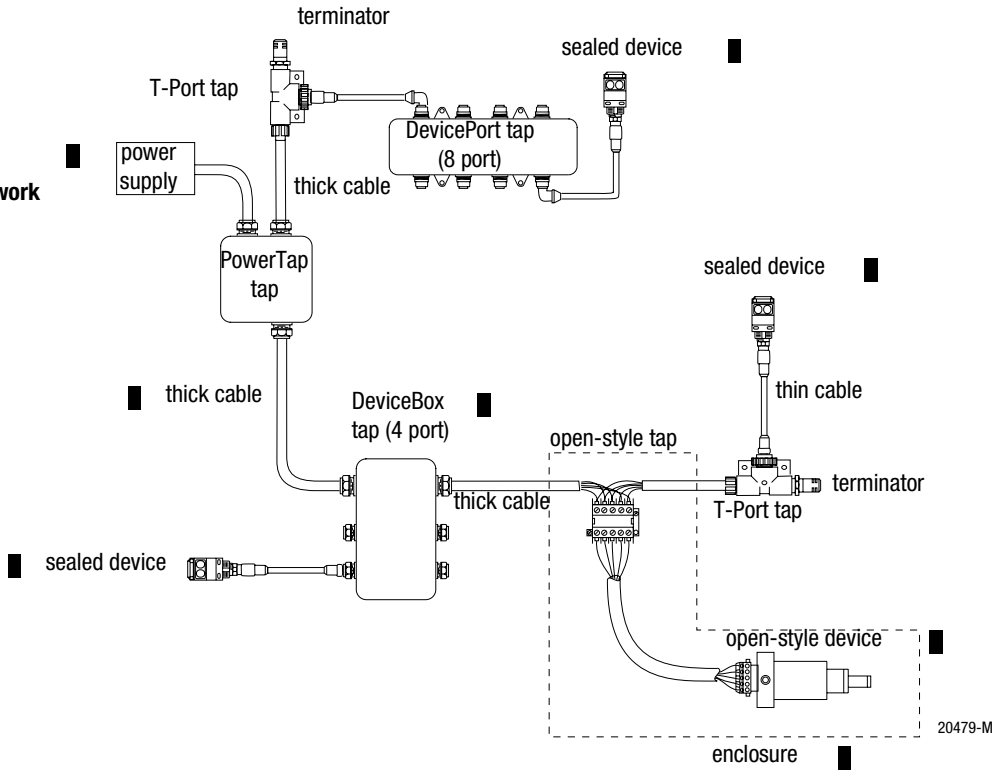
Important: ***** Devices default to node 63. Leave node 63 open to avoid duplicate node addresses when adding devices. Change the default node address after installation.

Identify Cable System Components

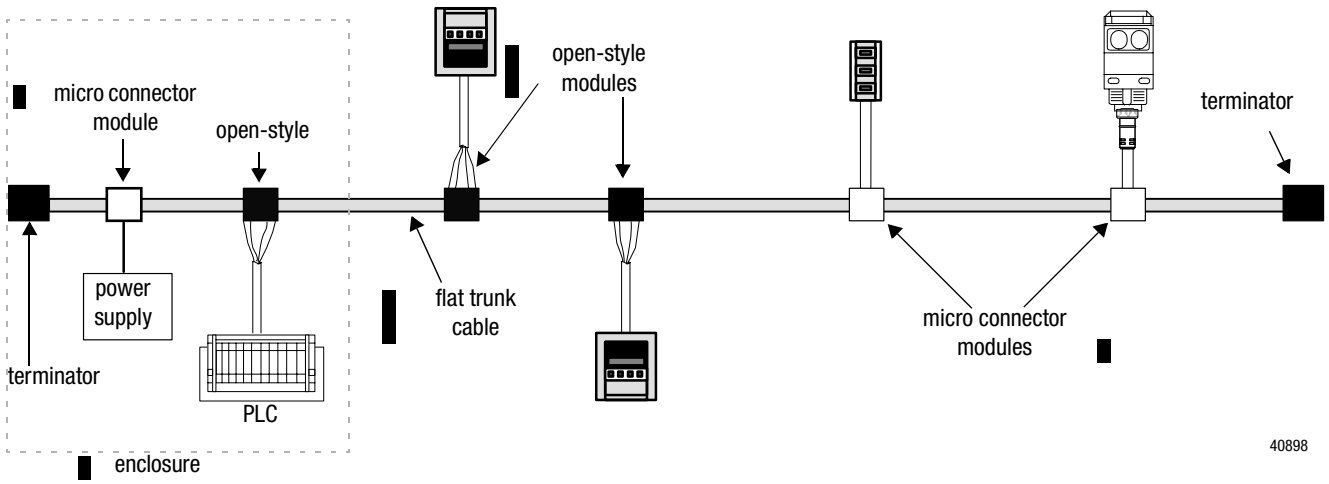
The free DeviceNet Assistant Software can be used to layout a DeviceNet System and generate a BOM. This can be downloaded at www.ab.com/networks/assistant.

Use this chapter to identify and become familiar with the basic DeviceNet cable system components.

Round (Thick and Thin) Cable Network



KwikLink Flat Media Network

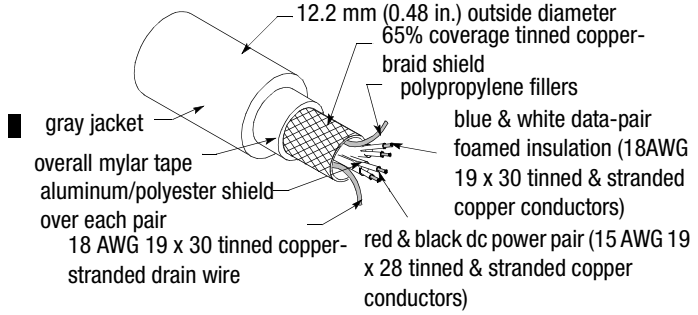


Component	Description	Component	Description
Trunk line	The cable path between terminators that represents the network backbone. - can be made of thick, thin, or flat cable - connects to taps or directly to device.	DeviceBox tap	A junction box that allows 2, 4, or 8 drop lines to connect to the trunk line.
Drop line	The drop line is made up of thick or thin cable. - connects taps to nodes on the network.	DevicePort tap	A junction box with sealed connectors that allows 4 or 8 drop lines to connect to the trunk line.
Node/device	An addressable device that contains the DeviceNet communication circuitry.	PowerTap tap	The physical connection between the power supply and the trunk line.
Terminating resistor	The resistor (121 W, 1%, 1/4 W or larger) attaches only to the ends of the trunk line.	Open-style tap	Screw terminals that connect a drop line to the trunk line.
Open-style connector	Used with devices not exposed to harsh environments.	KwikLink Micro tap	A single-port connection to flat cable available in both sealed and unsealed versions.
Sealed-style connector	Used with devices exposed to harsh environments.	KwikLink Open-Style tap	A single terminal connection to flat cable available only in unsealed versions.
T-Port tap	A single-port connection with sealed connector.	KwikLink Terminator	A terminating resistor for use with flat cable, available in both sealed and unsealed versions.

About Thick Cable

Thick cable, with an outside diameter of 12.2 mm (0.48 in.), is generally used as the trunk line on the DeviceNet network. *Thick cable can be used for trunk lines and drop lines.*

Class 2 Thick Cable	
Spool Size	**Part Number**
50 m (164 ft)	1485C-P1-A50
150 m (492 ft)	1485C-P1-A150
300 m (984 ft)	1485C-P1-A350
500 m (1640 ft)	1485C-P1-A500


12.2 mm (0.48 in.) outside diameter
65% coverage tinned copper-braid shield
polypropylene fillers
gray jacket
blue & white data-pair foamed insulation (18AWG 19 x 30 tinned & stranded copper conductors)
overall mylar tape
aluminum/polyester shield over each pair
18 AWG 19 x 30 tinned copper-stranded drain wire
red & black dc power pair (15 AWG 19 x 28 tinned & stranded copper conductors)
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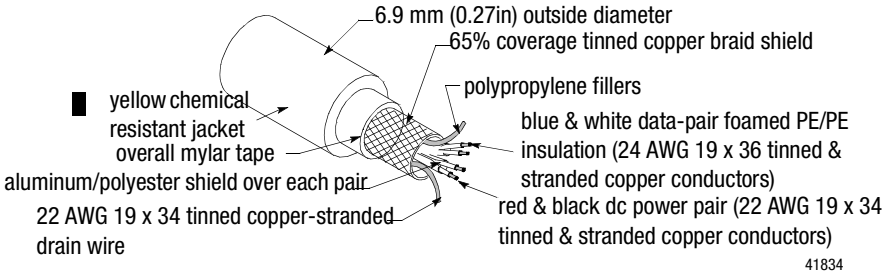
About Thin Cable

Thin cable, with an outside diameter of 6.9 mm (0.27 in.), connects devices to the DeviceNet trunk line via taps. *Thin cable can be used for trunk lines and drop lines.*

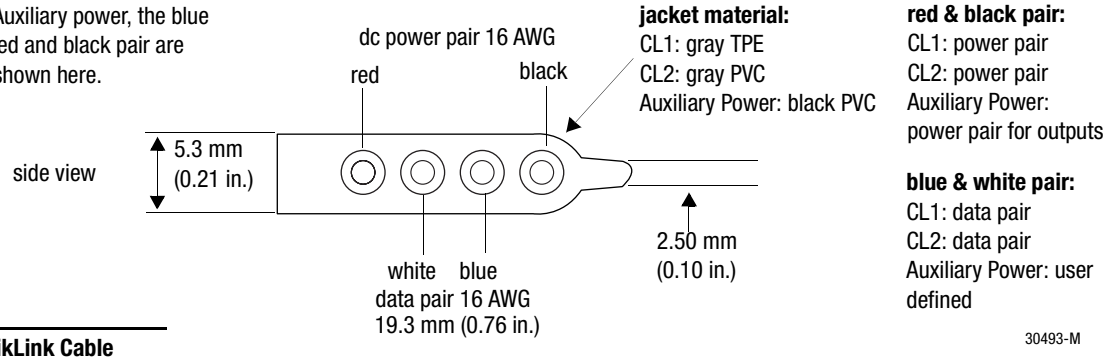
Class 2 Thin Cable	
Spool Size	**Part Number**
50 m (164 ft)	1485C-P1-C50
150 m (492 ft)	1485C-P1-C150
300 m (984 ft)	1485C-P1-C300
600 m (1968 ft)	1485C-P1-C600


6.9 mm (0.27in) outside diameter
65% coverage tinned copper braid shield
polypropylene fillers
yellow chemical resistant jacket
overall mylar tape
aluminum/polyester shield over each pair
22 AWG 19 x 34 tinned copper-stranded drain wire
blue & white data-pair foamed PE/PE insulation (24 AWG 19 x 36 tinned & stranded copper conductors)
red & black dc power pair (22 AWG 19 x 34 tinned & stranded copper conductors)
41834

About Flat Cable

KwikLink flat cable is physically keyed to prevent wiring mishaps. All three variations of KwikLink cable are unshielded and contain four conductors. *Flat cable is used exclusively for the trunk line.*

Cl1 and Cl2 cables, Auxiliary power, the blue and white pair, and red and black pair are used in the manner shown here.



Class 1 (CL1) KwikLink Cable	
Spool Size	**Part Number**
75 m (22.86 ft)	1485C-P1E75
200 m (60.96 ft)	1485C-P1E200
420 m (128 ft)	1485C-P1E420

Class 2 (CL2) KwikLink Cable	
Spool Size	**Part Number**
75 m (22.86 ft)	1485C-P1G75
200 m (60.96 ft)	1485C-P1G200
420 m (128 ft)	1485C-P1G420

KwikLink Power Cable	
Spool Size	**Part Number**
75 m (22.86 ft)	1485C-P1L75
200 m (60.96 ft)	1485C-P1L200
420 m (128 ft)	1485C-P1L420

Class 1 (CL1) Cable: Per NEC specifications for a Class 1 circuit (see Appendix A), the power source must have a rated output of less than 30V and 1000VA. Based on the size of the flat cable conductors, the maximum current through the network must be no more than 8A. Class 1 KwikLink cable is UL listed for 600V and 8A at 24V dc. Use Class 1 drops in conjunction with Class 1 flat cable.

Class 2 (CL2) Cable: More flexible than the CL1 cable, this design adheres to NEC Article 725, which states that for a Class 2 circuit, the power source must have a rated output of less than 30V and 100VA. In the case of DeviceNet, running at 24V, the maximum allowable current is 100VA/24V or 4A. KwikLink CL2 cable is rated to 4A at 24V dc.

Auxiliary Power Cable (CL1): Used to run an auxiliary bus to power outputs, i.e. valves, actuators, indicators. KwikLink power cable is a Class 1 cable capable of supplying 24V of output power with currents up to 8A.

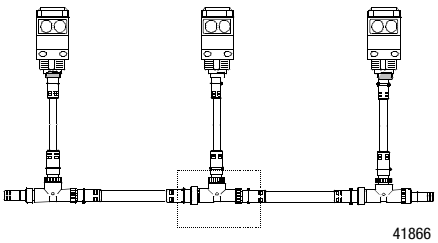
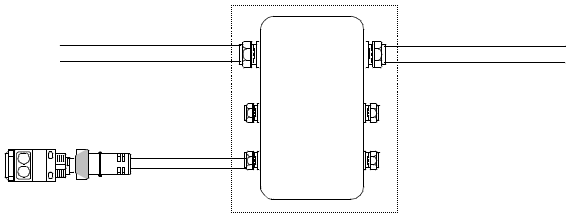
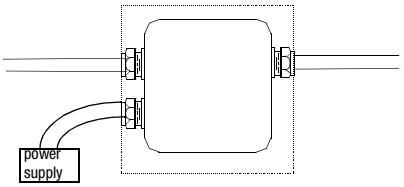
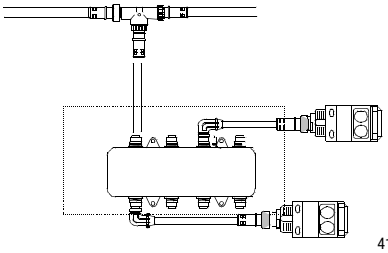
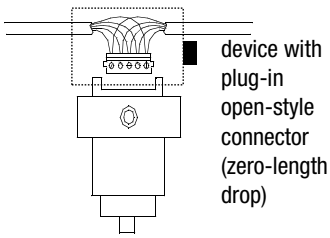
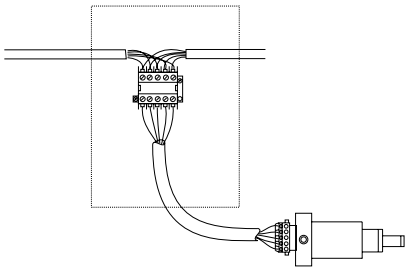
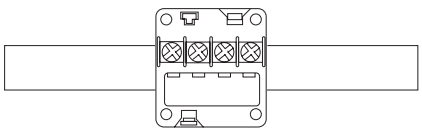
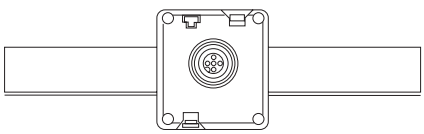
Important: The ArmorBlock MaXum cable base, 1792D-CBFM, is designed to use both the KwikLink network and Auxiliary Power cables. You should this base with all output modules.

Connecting to the Trunk Line

The cable system design allows you to replace a device without disturbing the cable system's operation.

Important: You must terminate the trunk line on each end with a 121 Ω, 1%, 1/4W resistor.

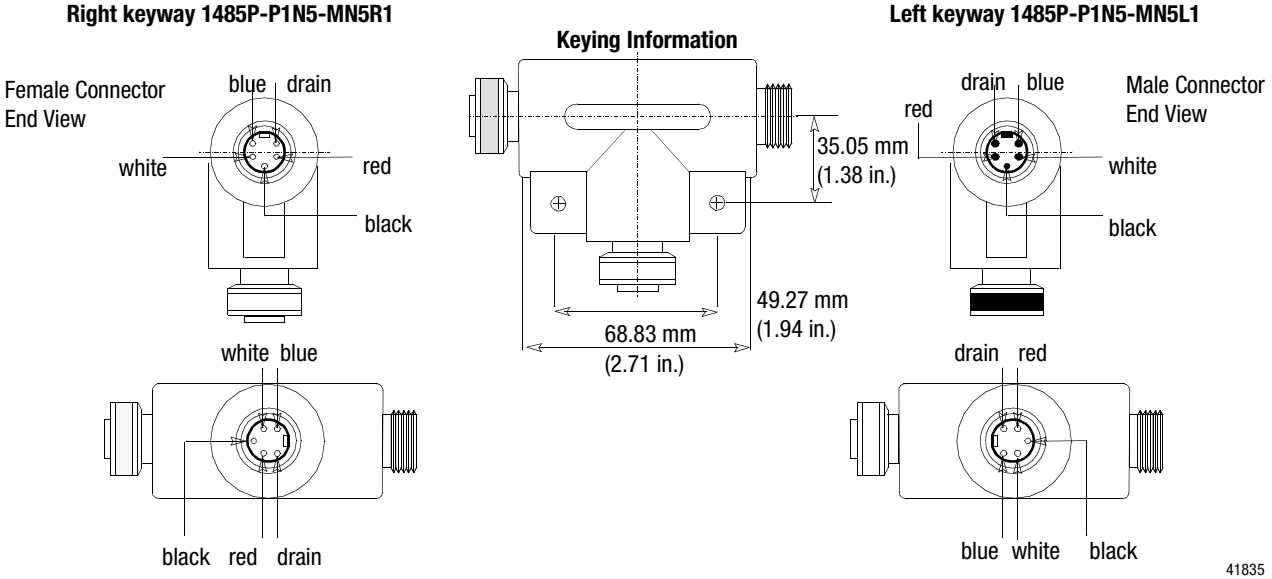
You can connect to the trunk line through a:

Trunk-line connection	See page	Trunk-line connection	See page
• T-Port tap	2-5	• DeviceBox tap	2-6
 41866		 41867	
• PowerTap	2-6	• DevicePort tap	2-7
 41868		 41869	
• Open-style connector	2-9	• Open-style tap	2-9
 41674		 41679	
• KwikLink open-style connector	2-11	• KwikLink micro connector	2-11
 30429		 30430	

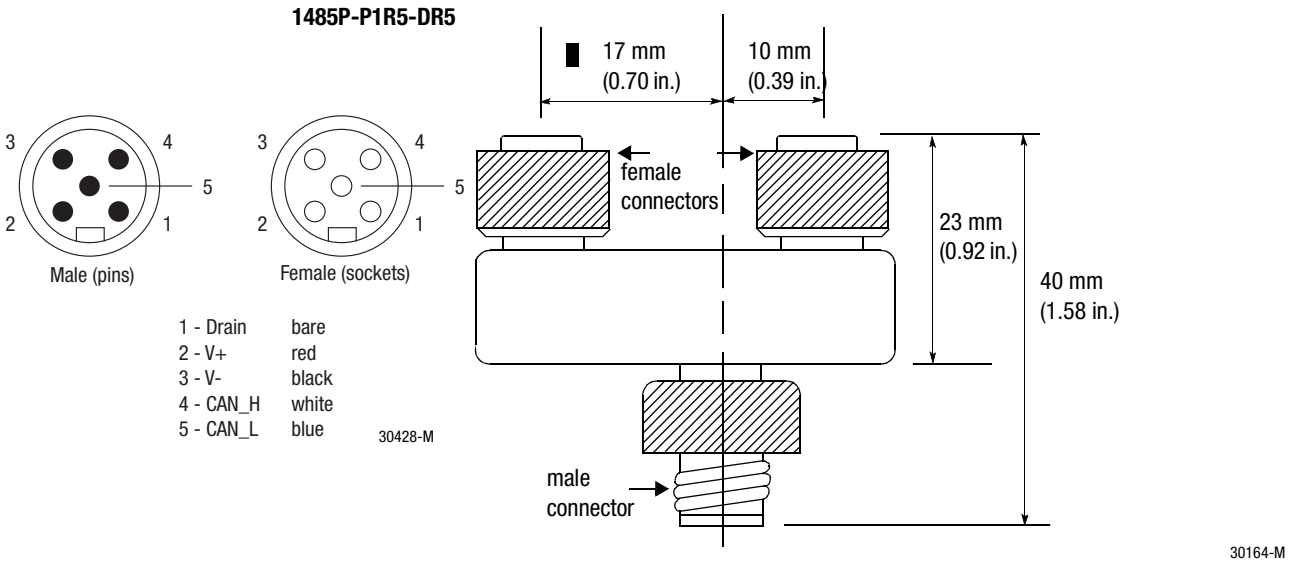
About the T-Port Tap

The T-Port tap connects to the drop line with a mini or micro quick-disconnect style connector. Mini T-Port taps provide right or left keyway for positioning purposes. **Mini T-Ports are also available with a micro (M12) drop connection (part number 1485P-P1R5-MN5R1).**

Mini T-Port tap



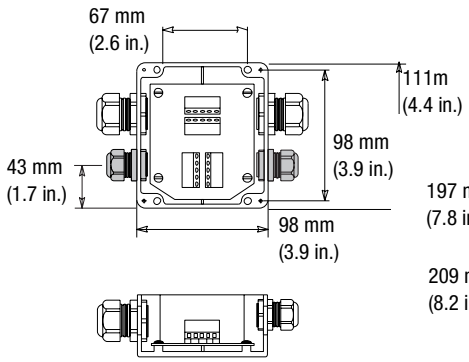
Micro T-Port tap



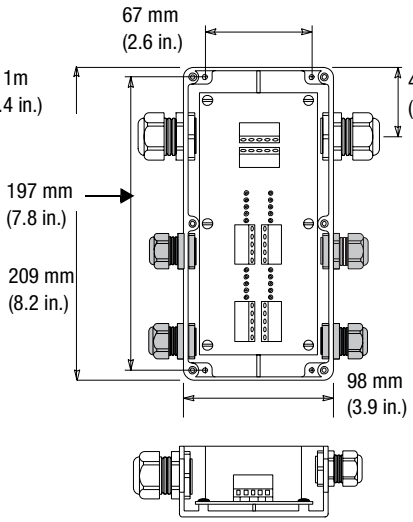
About the DeviceBox Tap

DeviceBox taps use round media only for a direct connection to a trunk line. They provide terminal strip connections for as many as 8 nodes using thin-cable drop lines. Removable gasket covers and cable glands provide a tight, sealed box that you can mount on a machine. Order DeviceBox taps according to the trunk type (thick or thin).

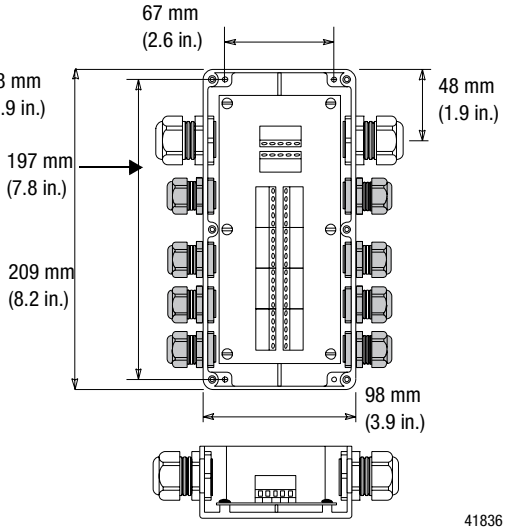
2-Port DeviceBox Tap
Thick trunk: 1485P-P2T5-T5
Thin trunk: 1485P-P2T5-T5C



4-Port DeviceBox Tap
Thick Trunk: 1485P-P4T5-T5
Thin Trunk: 1485P-P4T5-T5C



8-Port DeviceBox Tap
Thick Trunk: 1485P-P8T5-T5

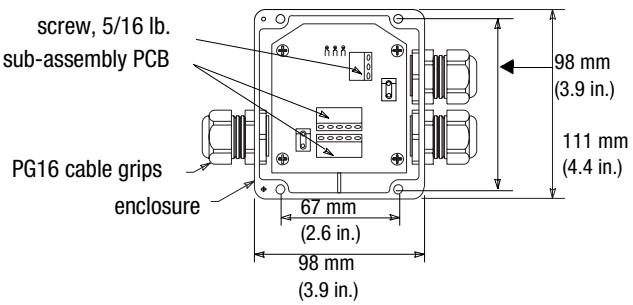


41836

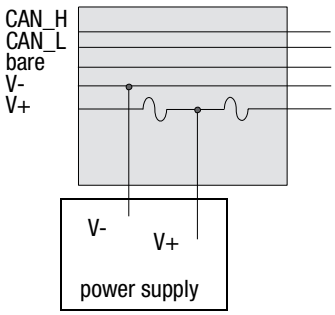
About the PowerTap

The PowerTap can provide overcurrent protection to the thick cable, 7.5A for each trunk. (Country and/or local codes may prohibit the use of the full capacity of the tap.) You can also use the PowerTap tap with fuses to connect multiple power supplies to the trunk line without back-feeding between supplies. PowerTap taps are only used with round media.

PowerTap tap - 1485T-P2T5-T5



schematic



Wire Color	Wire identity	Use
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power

41837

In cases in which the power supply provides current limiting and inherent protection, you may not need fuses/overcurrent devices at the tap.

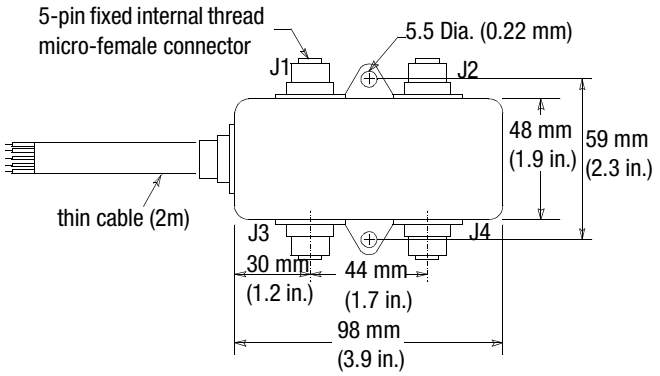
About the DevicePort Tap

DevicePort taps are multiport taps that connect to a round or flat media trunk line via drop lines. DevicePorts connect as many as 8 devices to the network through mini or micro quick disconnects.

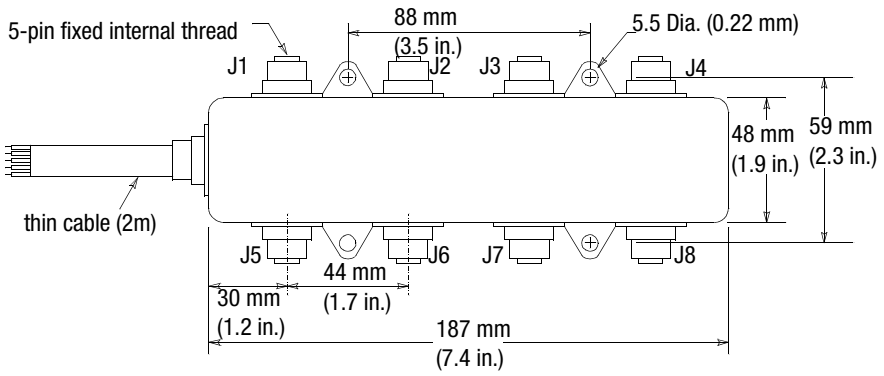
Micro DevicePorts

All device connections are micro female receptacles; only micro male connectors with rotating coupling nuts can interface with each port. Add "-M5" to these part numbers to get a mini-male connector at the end of a 2m cable for trunk connection.

4-Port DevicePort Tap with 2m Drop Line - 1485P-P4R5-C2



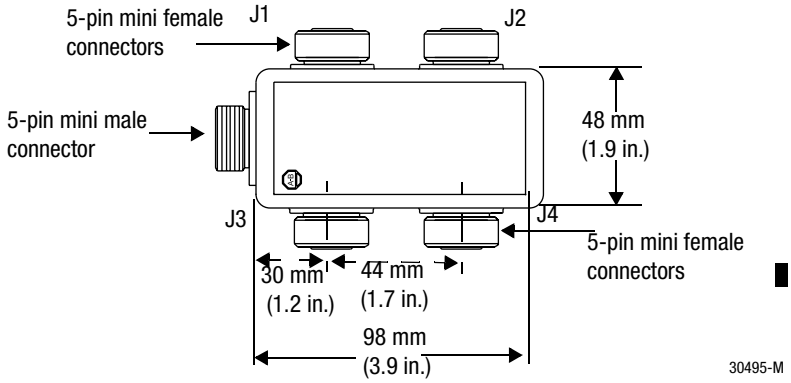
8-Port DevicePort Tap with 2m Drop Line - 1485P-P8R5-C2



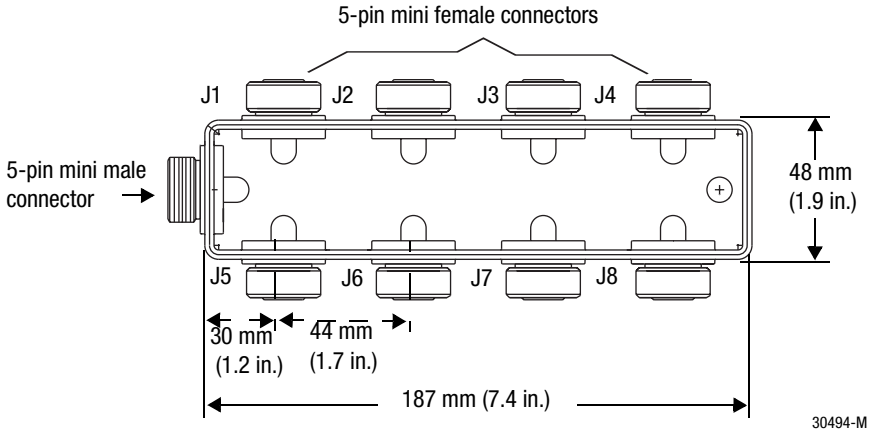
Mini DevicePorts

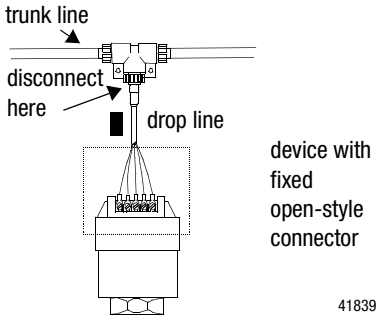
All device connections are mini female receptacles; only mini male connectors can interface with each port. Trunk connection is a mini male quick disconnect.

4-Port DevicePort tap with mini drop connection - 1485P-P4N5-M5



8-Port DevicePort Tap part number 1485P-P8N5-M5





About the Direct Connection

Connect devices directly to the trunk line only if you can later remove the devices without disturbing communications on the cable system.

Important: If a device provides only fixed-terminal blocks for its connection, you must connect it to the cable system by a drop line. Doing this allows you to remove the device at the tap without disturbing communications on the cable system.

Wire Color	Wire Identity	Usage Round
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power

About the Open-Style Connector

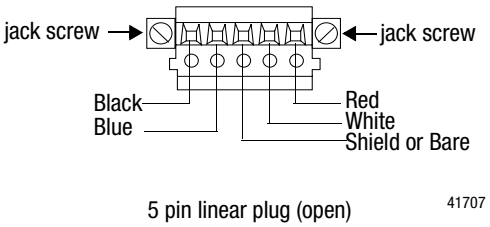
Open-style connectors come in two primary varieties:

- five-position (5 pin linear plug)
- ten-position (10 pin linear plug)

Ten-position connectors provide easier daisy-chaining because there is an independent wire chamber for each wire (entering cable and exiting cable).

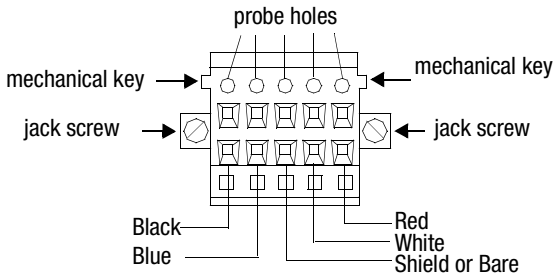
open-style connectors

PN 942154-05 (with jack screws)
PN 942153-05 (without jack screws)



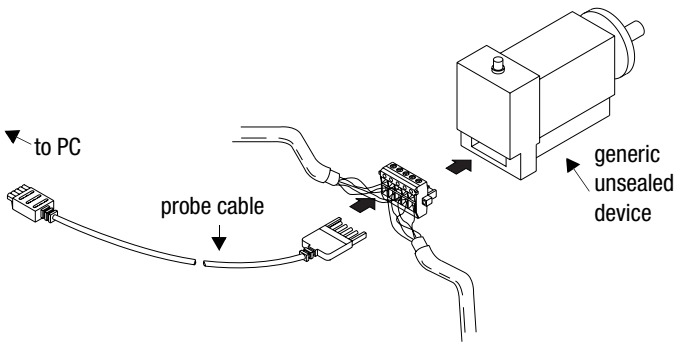
5 pin linear plug (open)

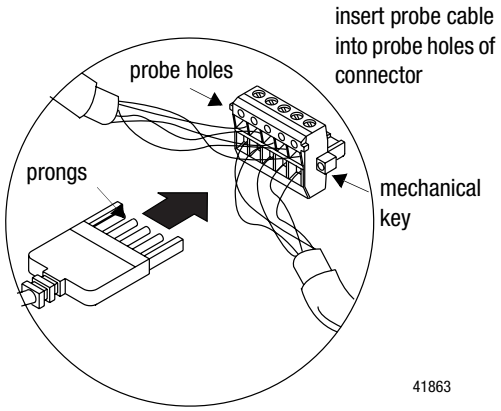
1787-PLUG10R



10-pin linear plug (open)

Some open-style connectors provide a temporary connection, for a PC or other configurable tool, using probe holes. For connection, insert the prongs of a probe cable into the probe holes of a connector. Mechanical keys on the connector prevent improper insertion.

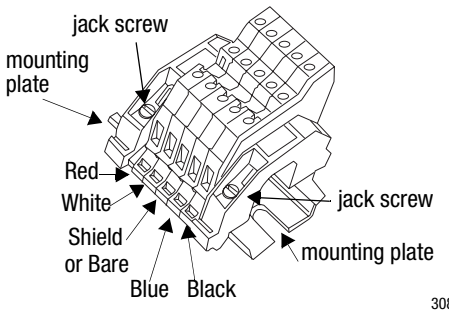




About the Open-Style Tap

Open-style taps provide a way for drop cables to be connected to the trunk line using open-style wiring connections. Three sets of 5-position color-coded wiring chambers accommodate all wires (for entering trunk cable, exiting trunk cable, and drop cable). The open-style tap can be mounted on a DIN-rail.

1492-DN3TW



Jack screws on open-style taps and connectors provide additional physical support.

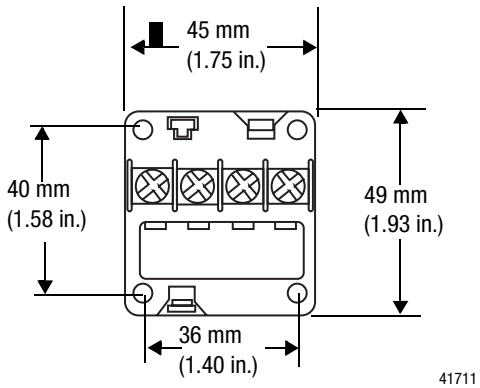
About KwikLink Insulation Displacement Connectors (IDCs)

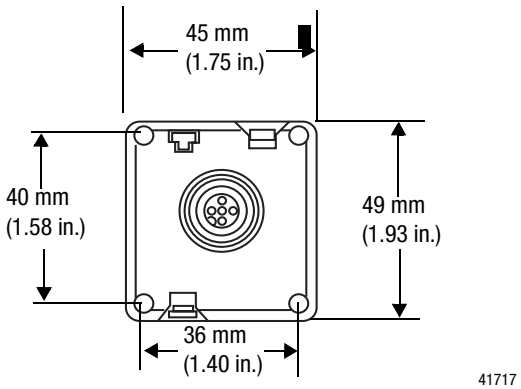
KwikLink Insulation Displacement Connectors (IDCs) interface drop cables and devices to the flat cable trunkline. The hinged, two-piece base snaps around the flat cable at any point along the trunk. Contact is made with the cable conductors by tightening two screws that drive the contacts through the cable jacket and into the conductors. The snap-on interface provides the connection to the drop cable and is available in micro- and open-style connectors.

Part Number	Description
1485P-P1E4-R5	NEMA 6P, 13; IP67 Micro module w/base
1485P-P1H4-R5	NEMA 1; IP60 Micro module w/base (no gaskets)
1485P-P1H4-T4	Open-style module w/base (no gaskets)

Allen-Bradley KwikLink connectors are only approved with the following DeviceNet flat cables:

Part Number	Description	Vendor	Color
1485C-P1E	CL1	Allen-Bradley	Gray
1485C-P1L	Aux. Power	Allen-Bradley	Black
1485C-P1G	CL2	Allen-Bradley	Gray





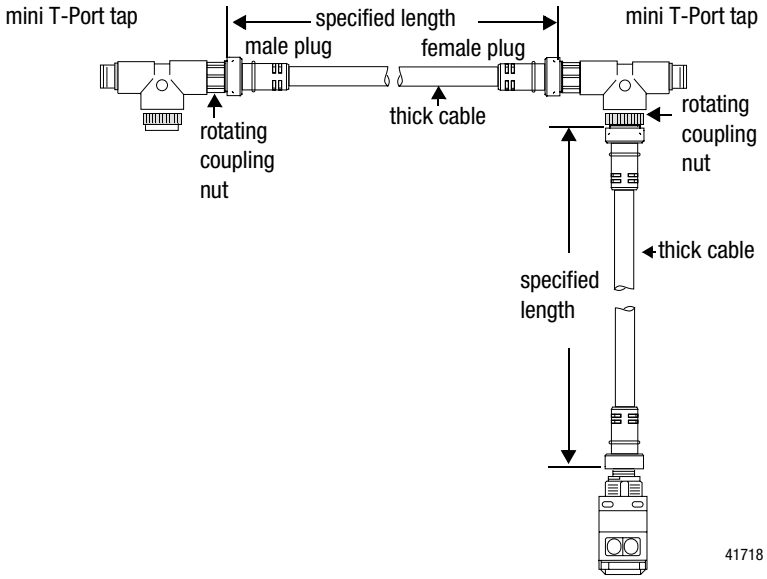
Using Preterminated Cables

Using preterminated cable assemblies saves you the effort of stripping and wiring connectors to the cable ends and also reduces wiring errors.

About Thick Cable

You can order thick cable in nine lengths with mini connectors at each end. Thick cable that is 6m (20ft) or shorter can also be used as drop lines.

Mini Male to Mini Female	Part Number
1 m (3.28 ft)	1485C-P1N5-M5
2 m (6.56 ft)	1485C-P2N5-M5
3 m (9.84 ft)	1485C-P3N5-M5
4 m (13.12 ft)	1485C-P4N5-M5
5 m (16.40 ft)	1485C-P5N5-M5
10 m (32.81 ft)	1485C-P10N5-M5
12 m (39.36 ft)	1485C-P12N5-M5
15 m (49.20 ft)	1485C-P15N5-M5
18 m (59.04 ft)	1485C-P18N5-M5



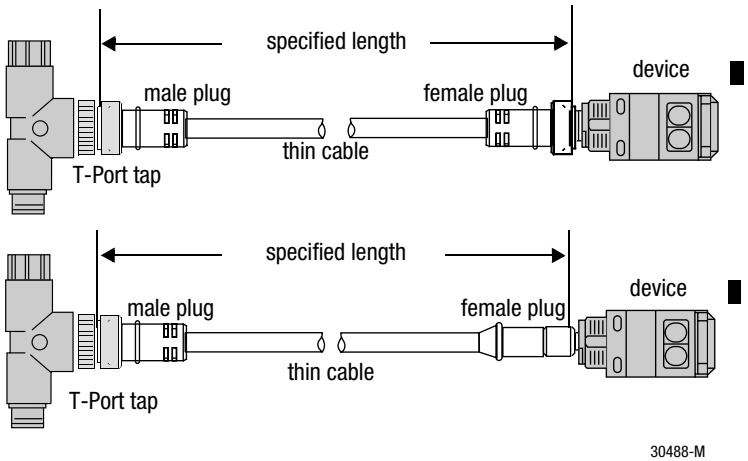
About Thin Cable

Preterminated thin cable assemblies for use as a drop line are available with various connectors in lengths of 1, 2, 3, and 5m. Preterminated thin cable assemblies can also be used as trunk lines.

Connecting to a T-Port tap from a sealed device

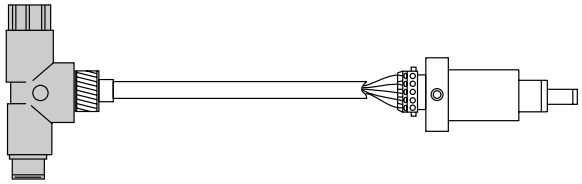
Mini Male to Mini Female	Part Number
1 m (3.28 ft)	1485R-P1N5-M5
2 m (6.56 ft)	1485R-P2N5-M5
3 m (9.84 ft)	1485R-P3N5-M5

Mini Male to Micro Female	Part Number
1 m (3.28 ft)	1485R-P1M5-R5
2 m (6.56 ft)	1485R-P2M5-R5
3 m (9.84 ft)	1485R-P3M5-R5
5 m (16.40 ft)	1485R-P5M5-R5



Connecting to a T-Port tap from an open device

Mini Male to Conductors	Part Number
1m (3.28ft)	1485R-P1M5-C
2m (6.56ft)	1485R-P2M5-C
3m (9.84ft)	1485R-P3M5-C



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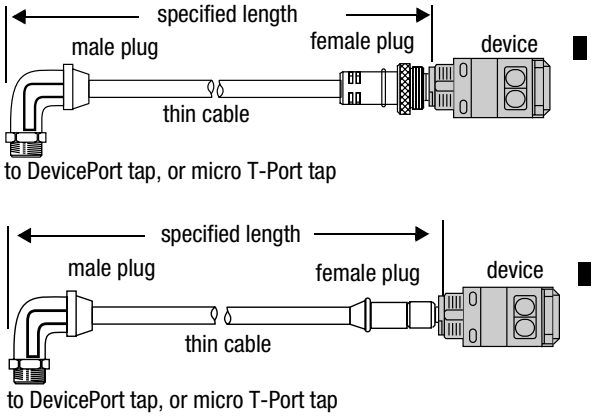
Connecting to a DevicePort tap or Micro T-Port tap from a sealed device

Micro Male 90° to Mini Female	Part Number
1m (3.28ft)	1485R-P1N5-F5
2m (6.56ft)	1485R-P2N5-F5

Micro Male 90° to Micro Female	Part Number
1m (3.28ft)	1485R-P1R5-F5
2m (6.56ft)	1485R-P2R5-F5
3m (9.84ft)	1485R-P3R5-F5

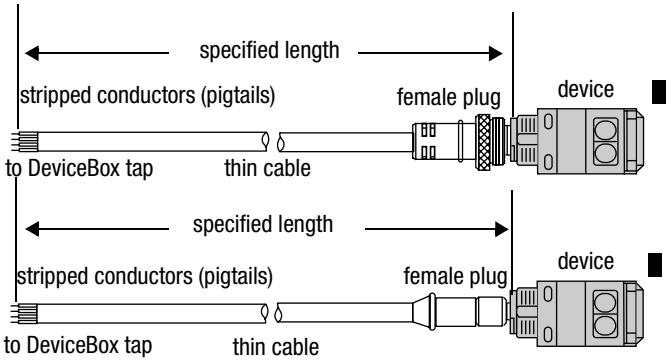


41720

Connecting to a DeviceBox tap or open-style tap from a sealed device

Mini Female to Conductor	Part Number
1m (3.28ft)	1485R-P1N5-C
2m (6.56ft)	1485R-P2N5-C
3m (9.84ft)	1485R-P3N5-C

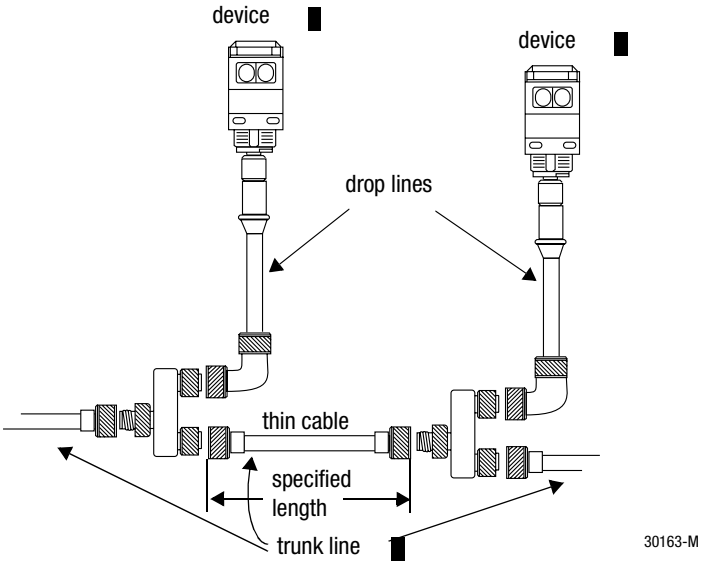
Micro Female to Conductor	Part Number
1m (3.28ft)	1485R-P1R5-C
2m (6.56ft)	1485R-P2R5-C
3m (9.84ft)	1485R-P3R5-C



41721

Connecting to micro T-Port taps

Micro Male 90° to Micro Female	Part Number
1m (3.28ft)	1485R-P1R5-D5
2m (6.56ft)	1485R-P2R5-D5
3m (9.84ft)	1485R-P3R5-D5
4m (13.12ft)	1485R-P4R5-D5



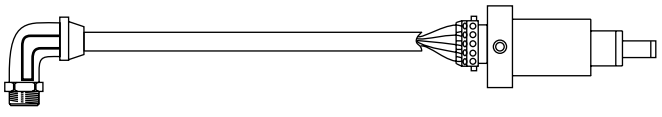
About KwikLink Drop Cables

These unshielded four-wire PVC drop cables were designed specifically for use with KwikLink connectors. Trunkline connections are 90° micro male to straight female, micro female or conductors at the device.

Important: These drop cables (1485K) are only for use with the KwikLink flat cable system. They are not suitable for use with standard DeviceNet round cable systems.

Connecting to a KwikLink tap from an open device

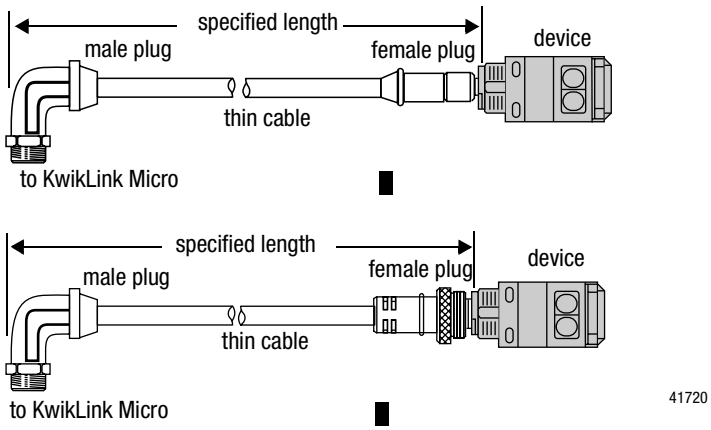
Micro Male 90° to Conductors	Part Number
1m (3.28ft)	1485K-P1F5-C
2m (6.56 ft)	1485K-P2F5-C
6m (19.68ft)	1485K-P6F5-C



Micro Male 90° to Micro Female	Part Number
1m (3.28 ft)	1485K-P1F5-R5
2m (6.56 ft)	1485K-P2F5-R5
3m (9.84 ft)	1485K-P3F5-R5
6m (19.68 ft)	1485K-P6F5-R5

Micro Male 90° to Mini Female	Part Number
1m (3.28 ft)	1485K-P1F5-N5
2m (6.56 ft)	1485K-P2F5-N5
3m (9.84 ft)	1485K-P3F5-N5

Connecting to a KwikLink tap from a sealed device



Wire Color	Wire Identity	Usage Round	Usage Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power

About Terminators

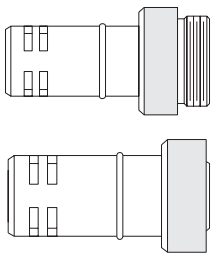
Electrically stabilize your DeviceNet communication with terminating resistors.

Important: You must terminate the trunk line on each end with a 121ohms, 1%, 1/4W resistor.

Sealed-style terminators (round media)

Male and female sealed terminators have gold plated contacts for corrosion resistance.

Description	Part Number
mini male	1485A-T1M5
mini female	1485A-T1N5



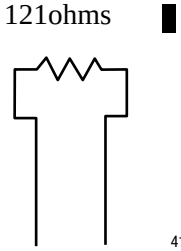
Unsealed-Style terminator (round and flat media)

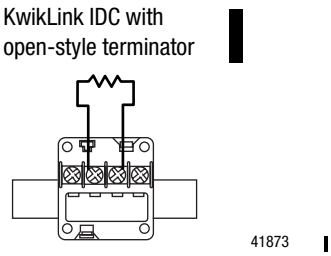
Important: You must connect these resistors directly across the blue and white wires of the DeviceNet cable.

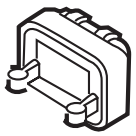
An open-style terminator is suitable for use with:

- DeviceBox taps
- open-style plugs or taps
- KwikLink open-style Insulation Displacement Connectors (IDC)

Description	Part Number
open-style terminator	1485A-C2



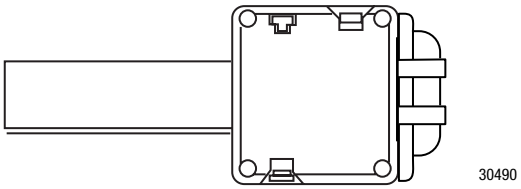




Sealed and unsealed flat media terminators

These terminators have an IDC base and are shipped with an end cap. Unsealed terminators do not have gaskets.

Description	Part Number
sealed terminator (IP67)	1485A-T1E4
unsealed terminator (no gasket IP60)	1485A-T1H4



Make Cable Connections

Preparing Cables

In Chapter 1, you determined the required lengths of trunk line and drop line segments for your network. To cut these segments from reels of thick, thin and flat cable, use a sharp cable cutter and provide sufficient length in each segment to reduce tension at the connector.

▶ Select an end of the cable segment that has been cleanly cut.
The positions of the color-coded conductors should match the positions at the face of the connector.

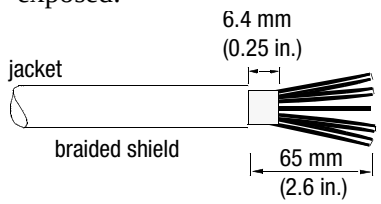
Important: Before beginning, make sure:

- the DeviceNet cable system is inactive
- all attached devices are turned off
- any attached power supply is turned off
- you follow the manufacturer's instructions for stripping, crimping, and/or tightening

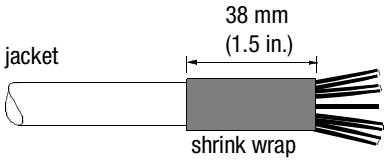
How to Install Open-Style Connectors

To attach a plug-in open-style connector to a round media (thick or thin) trunk line:

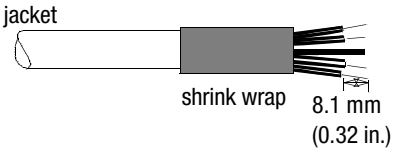
1. Strip 65 mm (2.6 in.) to 75 mm (2.96 in.) of the outer jacket from the end of the cable, leaving no more than 6.4 mm (0.25 in.) of the braided shield exposed.



2. Wrap the end of the cable with 38 mm (1.5 in.) of shrink wrap, covering part of the exposed conductors and part of the trunk line insulation.



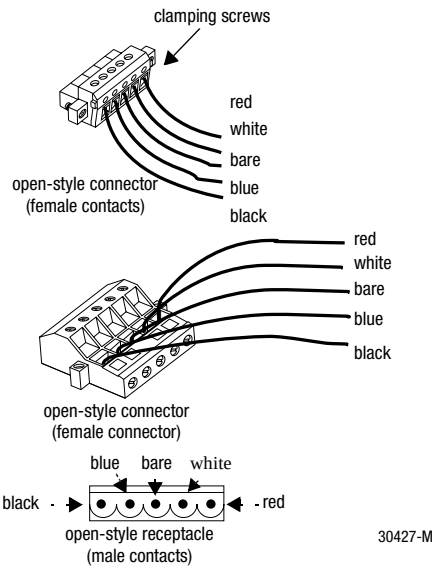
3. Strip 8.1 mm (0.32 in.) of the insulation from the end of each of the insulated conductors.



4. Tin the last 6.5 mm (0.26 in.) of the bare conductors so that the outside dimension does not exceed 0.17 mm (0.045 in.).

5. Insert each conductor into the appropriate clamping cavity of the open-style connector or the screw terminal on the device, according to the color of the cable insulation.

6. Tighten the clamping screws to secure each conductor. The male contacts of the device connector must match the female contacts of the connector.

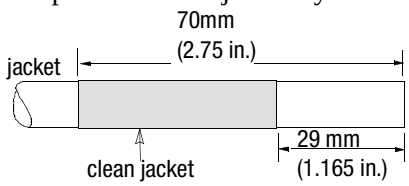


Wire Color	Wire Identity	Usage Round
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power

How to Install Mini/Micro Sealed Field-Installable Connectors

To attach a mini/micro sealed-style connector to round media:

1. Prepare the cable jacket by cleaning loose particles from the jacket.



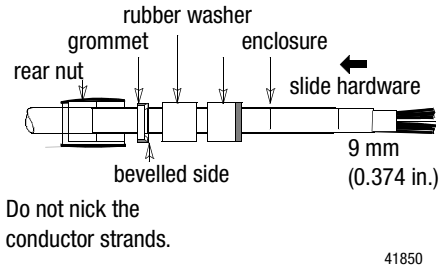
2. Strip 29 mm (1.165 in.) of the cable jacket from the end of the cable.

3. Cut the braided shield and the foil shields surrounding the power and signal conductors.

4. Trim the conductors to the same length.

5. Slide the connector hardware onto the cable in the order shown.

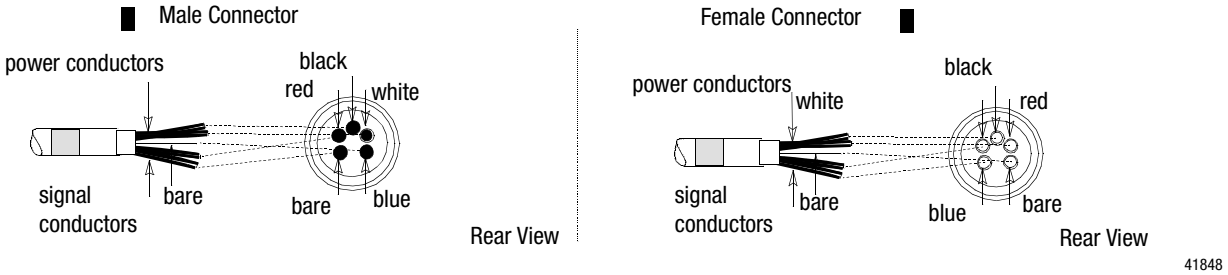
6. Strip 9 mm (0.374 in.) of insulation from the ends of all conductors except the bare drain wire.



Wire Color	Wire identity	Usage Round
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power

Important: Do not twist or pull the cable while tightening the gland nut.

7. Attach wires to the connector using screw terminals as seen in the following diagram.



8. Screw the enclosure body to the connector.

9. Screw the rear nut into the connector enclosure.

Important: Do not twist or pull the cable while tightening the rear nut.

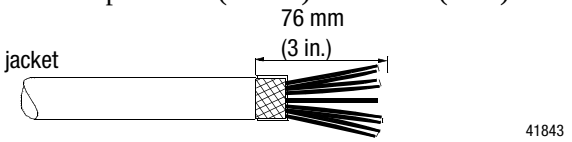
How to Install DeviceBox and PowerTap Taps

Cable preparation and attachment is the same for PowerTap taps and DeviceBox taps which use hard-wire connections of round media. To install your taps, perform the following steps and then proceed to the appropriate section for wiring the specific tap.

1. Remove the cover from the tap.

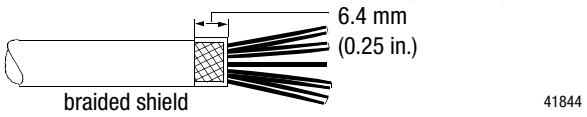
2. Prepare the ends of the cable sections.

A. Strip 65 mm (2.6 in.) to 76 mm (3 in.) of the outer jacket

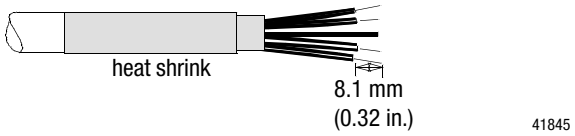


and braided shield from the end of the cable.

– Leave no more than 6.4 mm (0.25 in.) of the braided shield exposed.



B. Strip 8.1 mm (0.32 in.) of the insulation from the end of each of the insulated conductors.



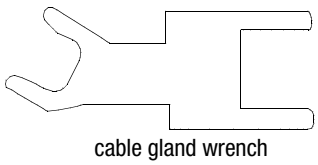
3. Attach cables to the enclosure.

A. Loosen the large gland nuts.

B. Insert cables through the large cable glands so that about 3.3 mm (0.13 in.) of the cable jackets extend beyond the locking nut toward the inside of the enclosure.

C. Hold the hex flange in place with the cable gland wrench, and firmly tighten the gland nut. The cable gland wrench is supplied with the accessories kit, part number 1485A-AccKit.

1485A-AccKit



4. Proceed to the appropriate section.

For information about	See page
installing PowerTap taps	3-5
installing DeviceBox taps	3-7
installing DevicePort taps	3-8

How to Install PowerTap Taps

The PowerTap tap contains terminal blocks that connect the trunk line conductors and the input from a power supply. It is used only with round media. Gland nuts secure cables to the PowerTap enclosure.

Important: As you make the attachments inside the tap, be certain:

- that conductors inside the enclosure loop around the fuses for easy access to the fuses.
- the bare conductor is insulated in the enclosure with the insulating tubing supplied in the accessory kit.
- the blue plastic covers are firmly attached to the fuse assemblies before applying power.

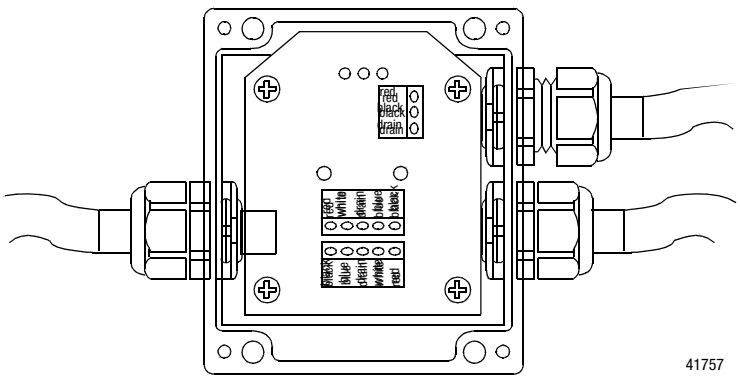
Important: The two fuses used in the PowerTap tap are 7.5A fast-acting automotive type which you can order from your local fuse supplier (ACT type).

To attach a PowerTap:

1. Cut and strip the thick cable back approximately 100 mm (4 in.).

Wire Color	Wire identity	Use
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power

2. Loosen the gland nut.



3. Insert the cable into the PowerTap through the large cable gland until approximately 3 mm (0.12 in.) of the cable jacket protrudes.

4. Cable used for input from a power supply should have the white and blue leads cut off short.

5. Firmly tighten the gland nut to provide strain relief and sealing.

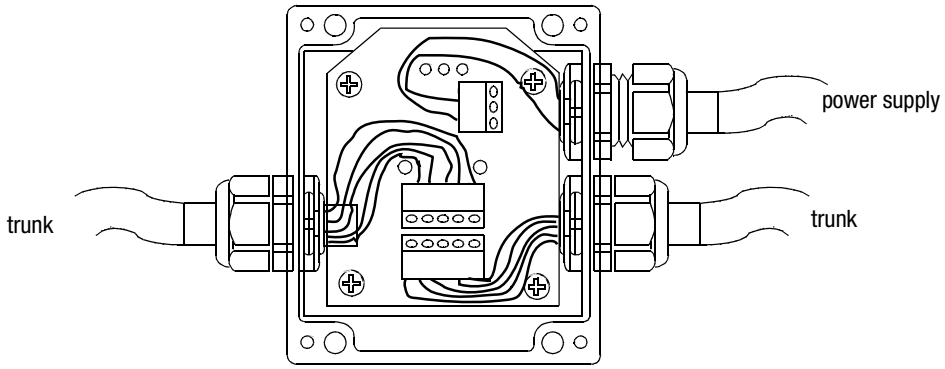
ATTENTION: You must hold the hex flange with the cable gland wrench during tightening.

6. Firmly twist the bare wire ends to eliminate loose strands.

ATTENTION: Be certain that you use insulating tubing (included with the accessory kit) on bare drain wire.

7. Loop each bare wire as shown below so you may insert the terminal block into the clamping cavity.

PowerTap Tap - 1485T-P2T5-T5



8. Firmly tighten the terminal block screw to clamp the bare wire end in place.

9. After all cables are terminated, secure the cover and tighten the screws to obtain the washdown rating.

10. Tighten all wire glands.

How to Install DeviceBox Taps

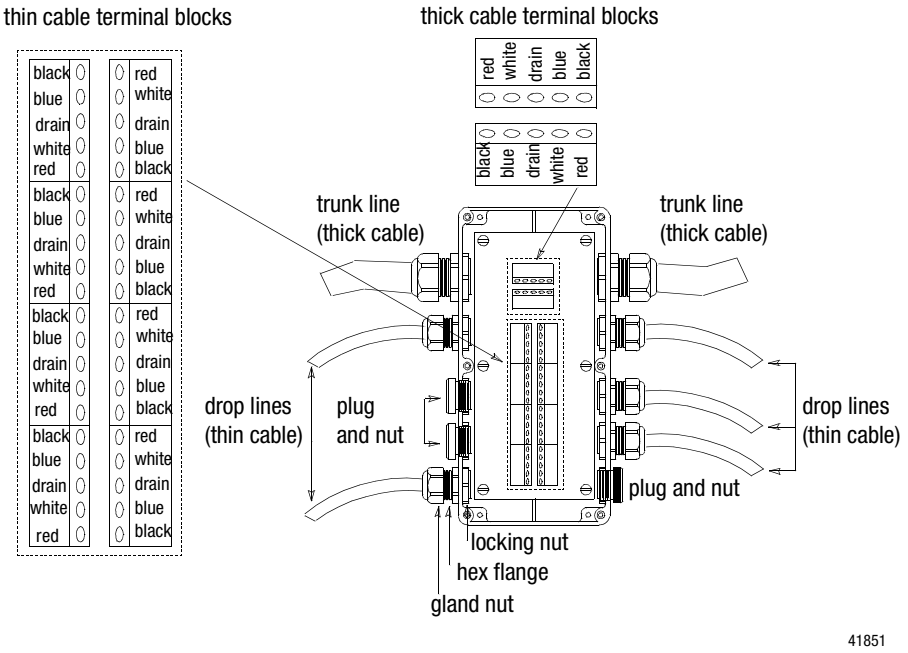
The DeviceBox tap contains terminal blocks that connect the trunk line and as many as eight drop lines. It is used only with round media. Gland nuts secure the cables entering the ports of the DeviceBox tap.To attach a DeviceBox tap:

1. Cut the required lengths from reels of trunk line using a sharp cable cutter providing sufficient length in each segment to reduce tension at the connection.

Important: Cover the bare drain wire in the enclosure with the insulating tubing supplied in the accessory kit.

2. Insert conductors into the terminal block clamping cavities, following the color coding specified for the terminal blocks at the incoming and outgoing thick cables and as many as eight thin cables.

Wire Color	Wire identity	Use
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power



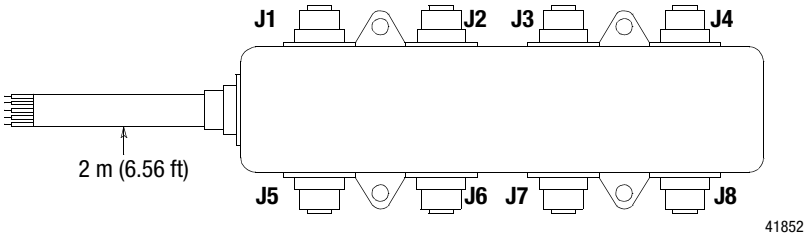
3. Tighten all clamping screws to secure conductors to the terminal blocks.

4. Seal unused ports with nylon plugs and nuts in the accessory kit.

5. Tightly secure the cover to the enclosure.

How to Install DevicePort Taps

The DevicePort tap connects as many as eight quick-disconnect cables to the trunk line.



To Connect Drop Lines

Drop lines, made up of thick or thin cable, connect devices to taps. Connections at the device can be:

- open-style
  - pluggable screw connectors
  - hard-wired screw terminals
  - soldered
- sealed-style
  - mini quick-disconnect connectors
  - micro quick-disconnect connectors

Important: It is best to connect drop lines when the cable system is inactive. If you must connect to an active cable system, make all other connections before the connection to the trunk line.

ATTENTION: Although it is possible to make a screw-terminal connection while the cable network is active, you should avoid this if at all possible.

To connect drop lines:

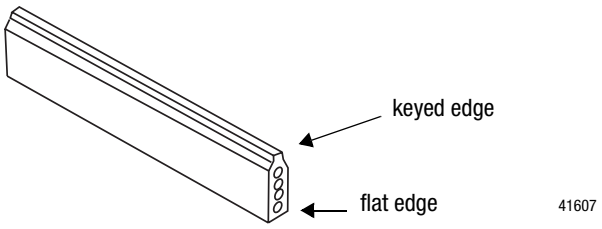
1. Attach contacts as described earlier in this section.
2. Connect the cable to the device.
3. Make any intermediate connections.
4. Make the connection to the trunk line last.

Important: Follow the wiring diagrams for each connection, and make sure you do not exceed the maximum allowable length from the device connection to the trunk connection.

KwikLink Installation Instructions

How to Install a KwikLink Connector

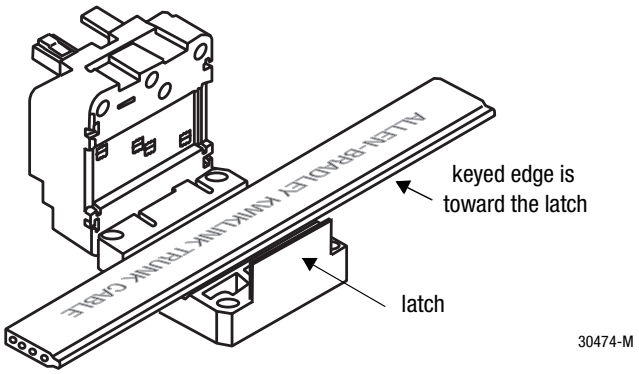
Install KwikLink cable with the wider flat edge of the cable on the bottom.



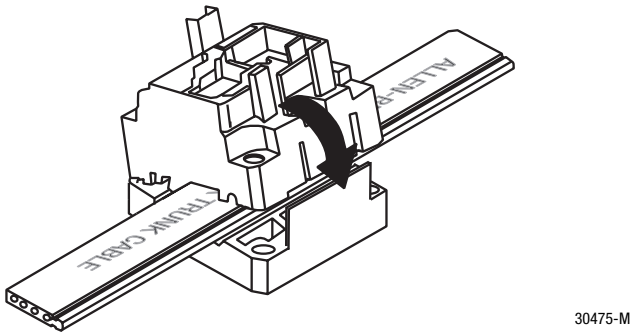
Follow these steps to properly install KwikLink cable into a connector:

1. Lay the cable in the hinged base, paying attention to the keyed profile; the unkeyed edge is closer to the hinge, the keyed edge is toward the latch.

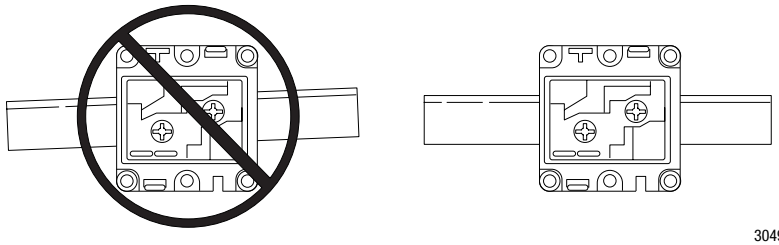
Important: Prior to closing the connector, make sure the IDC blades do not protrude from the housing. If the blades are exposed, gently push them back into the base. In the event that the blades do not retract easily (or retract only partially), verify that the IDC screws are not partially driven.



2. Close the hinged assembly, applying pressure until the latch locks into place.The latch has two catches. The first catch loosely holds the connector on the cable. The second catch needs more pressure applied to close the connector tightly. If the cable is not in the correct position, the connector will not close.



3. Make sure the cable is straight before moving on to step four.

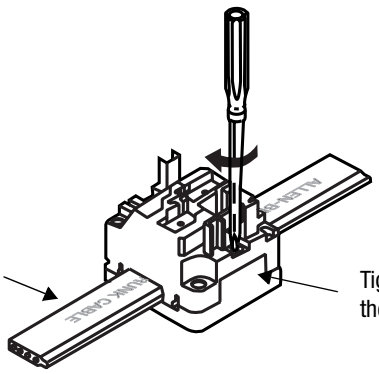


30492-M

ATTENTION: You must make sure the cable is straight before tightening the screws. Improper seating of the cable may cause a weak seal and impede IP67 requirements.

4. Tighten down the two screws at the center points of the hinge and latch sides of the base; tighten down the latch side first. Take care to avoid stripping, ample torque should be 5.56 N (15 in-lbs). Mount the base to the panel by driving screws through the corner holes not containing the metal inserts.

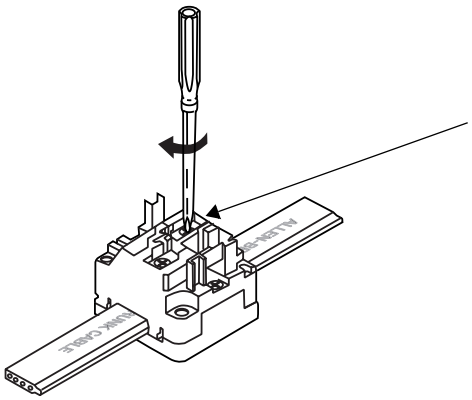
Check the cable position prior to tightening the screws.



30476-M

5. Drive the IDC contacts into the cable by tightening down the two screws in the center of the base assembly. Once again, be careful to avoid stripping, ample torque should be 5.56 N (15 in.-lbs).

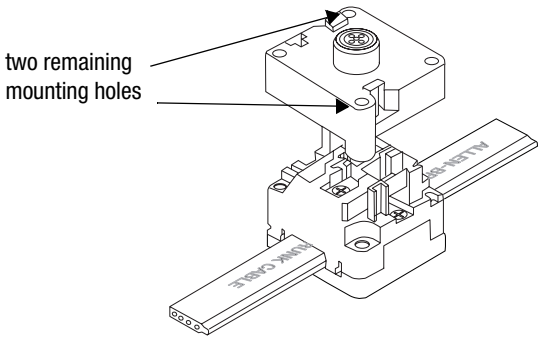
The module should not be removed after connection is made. Determine the exact placement of the connector **before** engaging the IDC contacts.



ATTENTION: Once the IDC contacts are driven into the cable, the module should not be removed.

30477-M

6. Line up the keyed rectangular holes of the micro/open/terminator connection interface with the matching posts on the base and snap the micro module into place. **Optional:** Secure the micro/open/terminator module by driving screws through the two remaining mounting holes.



Additional considerations: When used in flexing applications, the cable must be secured to a solid reference with mounting hardware 10-15 cm (4-6 in.) from the connector.

- Installation of connectors is recommended only at temperatures of 0°C - 75°C.
- Make sure the cable is free of debris or scratches before attaching the connector to ensure a proper seal.
- The recommended distance between mounts is 3-5 m (10-16 ft); flat cable mount-1485A-FCM.
- When running cable into an enclosure, use flat cable gland 1485A-CAD.

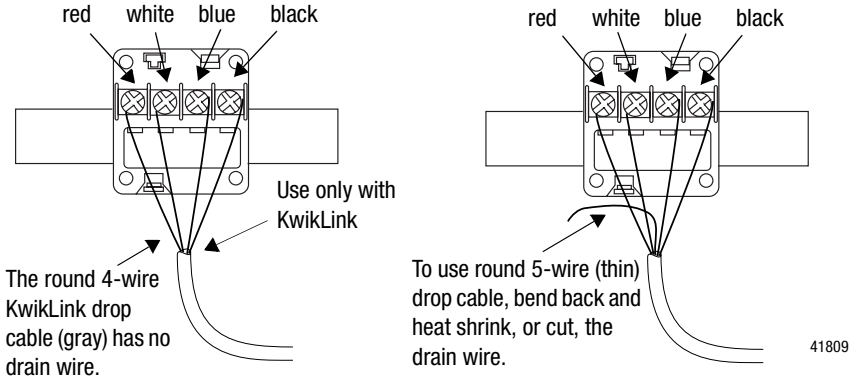
Installing a KwikLink open-style connector to a drop cable

Install the KwikLink open-style connector to the flat media using the directions starting on page 3-9. Prepare the drop cable following the directions on page 3-2 numbers 1 through 5. For flat media connections you can use:

- round 4-wire (KwikLink) drop cable (1485K series)
- round 5-wire (thin) drop cable (1485R series)

  – You must cut or heat shrink the drain wire when you use round 5-wire (thin) drop cable.

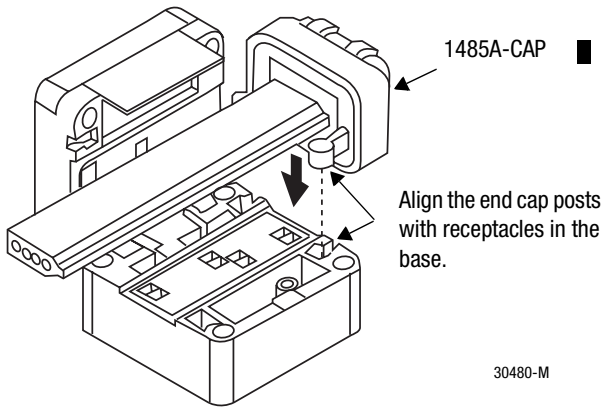
Wire Color	Wire identity	Use	Flat
white	CAN_H	signal	signal
blue	CAN_L	signal	signal
bare	drain	shield	n/a
black	V-	power	power
red	V+	power	power



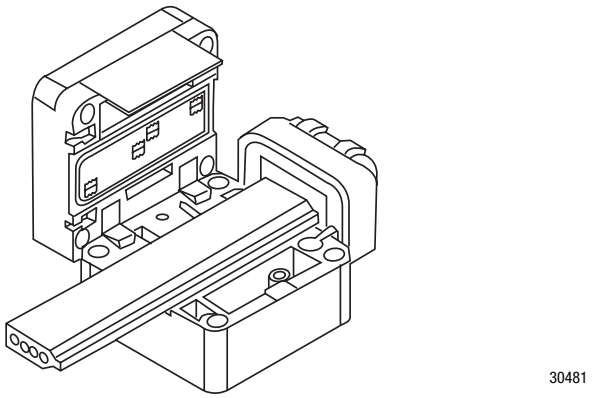
End Cap Installation

Each KwikLink terminator module is supplied with an end cap designed to cover the exposed end of the cable. To install the end cap:

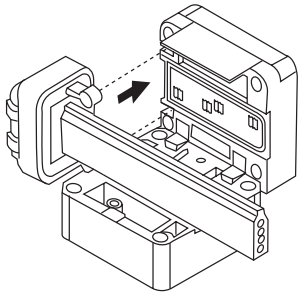
1. Fit the end cap (1485A-CAP) on the cable as keyed. Align the end cap posts with the receptacles in the lower IDC base and press down until the end cap is firmly seated (the upper surface of the posts will be flush with the upper surface of the base).

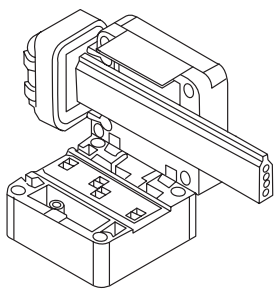


2. Close the IDC base and continue with the connection process as illustrated on page 3-9.



When installing an end cap on the other end of the cable, note that the guide receptacles are on the upper portion of the IDC base. Repeat the end cap installation process as outlined previously. Close the IDC base and continue with connection as illustrated in the standard installation instructions starting on page 3-9.





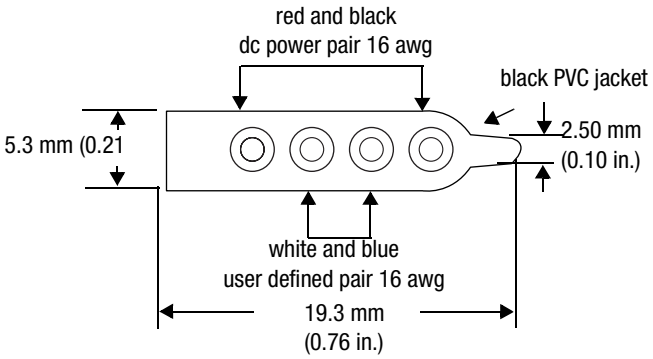
Auxiliary Power Cable	
Spool Size	**Part Number**
75 m (246 ft)	1485C-P1-L75
200 m (656 ft)	1485C-P1-L200
420 m (1378 ft)	1485C-P1-L420

Auxiliary Power Cable

Wire Color	Wire identity	Use
white	user defined	user defined
blue	user defined	user defined
black	V-	output power
red	V+	output power

Installing Auxiliary Power Cable

Install Auxiliary Power Cable as you would network cable. Refer to page 3-9 for installation instructions. You can use Auxiliary Power Cable with the ArmorBlock MaXum cable base (1792D-CBFM) and I/O modules (1792D series).



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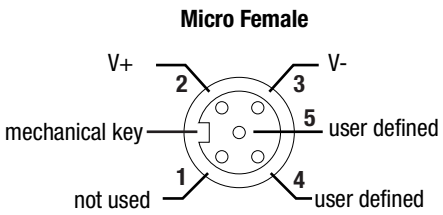
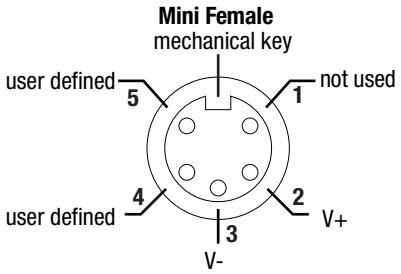
When running cable into an enclosure, use flat cable gland 1485A-CAD.

Pinout diagrams for mini and micro connections to the power cable are shown next.





30489-M

Connecting Power Supplies to Round Media

To supply power you will need to install and ground the power supplies as well as connect all PowerTap taps.If you haven't determined power supply placement, see Chapter 4. To install a power supply:

Important: Make sure the ac power source remains off during installation.

1. Mount the power supply securely allowing for proper ventilation, connection to the ac power source, and protection from environmental conditions according to the specifications for the supply.
2. Connect the power supply using:

- a cable that has one pair of 12 AWG conductors or the equivalent or two pairs of 15 AWG conductors
- a maximum cable length of 3m (10 ft) to the PowerTap tap

- the manufacturer's recommendations for connecting the cable to the supply

Connecting Power Supplies to KwikLink Flat Media

Class 1, 8A System

For a Class 1, 8A System, power may only be interfaced with the network using a KwikLink open-style connector.

Class 2, 4A System

For a Class 2, 4A System, power may be applied to the network using KwikLink micro or open-style connectors.

Determine Power Requirements

In this chapter, we describe two methods for determining your system's power requirements:

- the look-up method
- the full calculation method

Try the look-up method first, then move on to the full calculation method if you cannot meet your configuration requirements.

Important: You must consider two areas when powering output devices using the DeviceNet power supply:

- (1) Wide DeviceNet voltage range of 11-25V dc
- (2) Noise or transient protection at each device

You must calculate a worst-case situation, and maintain voltage within the 11-25V dc range on all segments. This can be accomplished using diodes or other similar techniques. See Appendix B, Powering Output Devices, for more information.

Class 1 (CL1) cable

Per NEC specifications for a Class 1 circuit (see NEC Article 725), the energy in the circuit anywhere is limited to 1000 VA. A Class 1 circuit requires that the cables used must have jacketing with 600V isolation and pass the CL1 burn test.

DeviceNet specifies the power source to be a regulated maximum of 24V dc and the power circuit is limited to 8A. Applying this to a Class 1 circuit running at 24V dc, a DeviceNet certified cable with a 600V jacket isolation rating meets all requirements to be used in a Class 1 circuit. So, based on DeviceNet specification, the cable's power carrying conductors are sized for an 8A maximum load.

Class 2 (CL2) Cable

Per NEC specifications for a Class 2 circuit (see NEC Article 725), the energy in the circuit anywhere is limited to 100 VA and the cable's jacketing used must have a 300V minimum isolation rating. Based on a 30V dc system your circuit would be limited to 3.3A.

DeviceNet specifies the power source to be a maximum of 24V dc. Applying this to a Class 2 circuit running at 24V dc, the maximum allowable current is 4A. A DeviceNet certified cable with a 300V jacket isolation rating meets all requirements to be used in a Class 2 circuit. So, based on the DeviceNet specification, the cable's power carrying conductors, are sized for a 8A maximum load.

Allen-Bradley and other suppliers of DeviceNet physical components use the above information to provide components you can use to cable DeviceNet systems.

The current Allen-Bradley Thick cable power conductors are sized to handle at least 8 amps of power. However, NEC and CEC regulations force this cable to be a CL2 (100 VA, 4 amp max) cable due to the construction of the cable. Specifically, the insulation on the data pair is a foam PE, which will not pass at CL1 burn test. As a result, any system using a Thick trunk and Thin drop must be a CL2 installation in US and Canada.

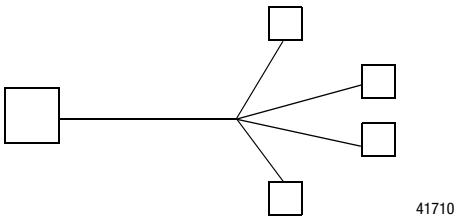
The new Allen-Bradley **KwikLink** trunk cable is rated for CL1 applications and the conductors can carry 8 amps of power. As a result, when using an Allen-Bradley **KwikLink** trunk the user can work under CL1 guidelines. For more information, see Appendix A.

The DeviceNet specifications provide for both "open and closed style" wiring terminations. You can engineer a wiring system for a DeviceNet installation that lays out a trunk line in accordance with the requirements of the Class 1 guidelines and uses drop lines in accordance with Class 2 guidelines. Care must be taken at the point where the two guidelines meet. At that point you must put in place a way to limit the energy on each wire to be in accordance with the NEC guidelines. In short, the energy in the drop line must be limited to no more that 100 VA. How you accomplish that is your decision. Most people resolve this issue by isolating the trunk from the drop line with different power sources. Other ways to limit energy may give you the same protection.

Use the Look-Up Method

To determine if you have adequate power for the devices in your cable system, see the following examples and figures. You have enough power if the total load does not exceed the value shown by the curve or the table.

In a worst-case scenario, all of the nodes are together at the opposite end of the power supply.



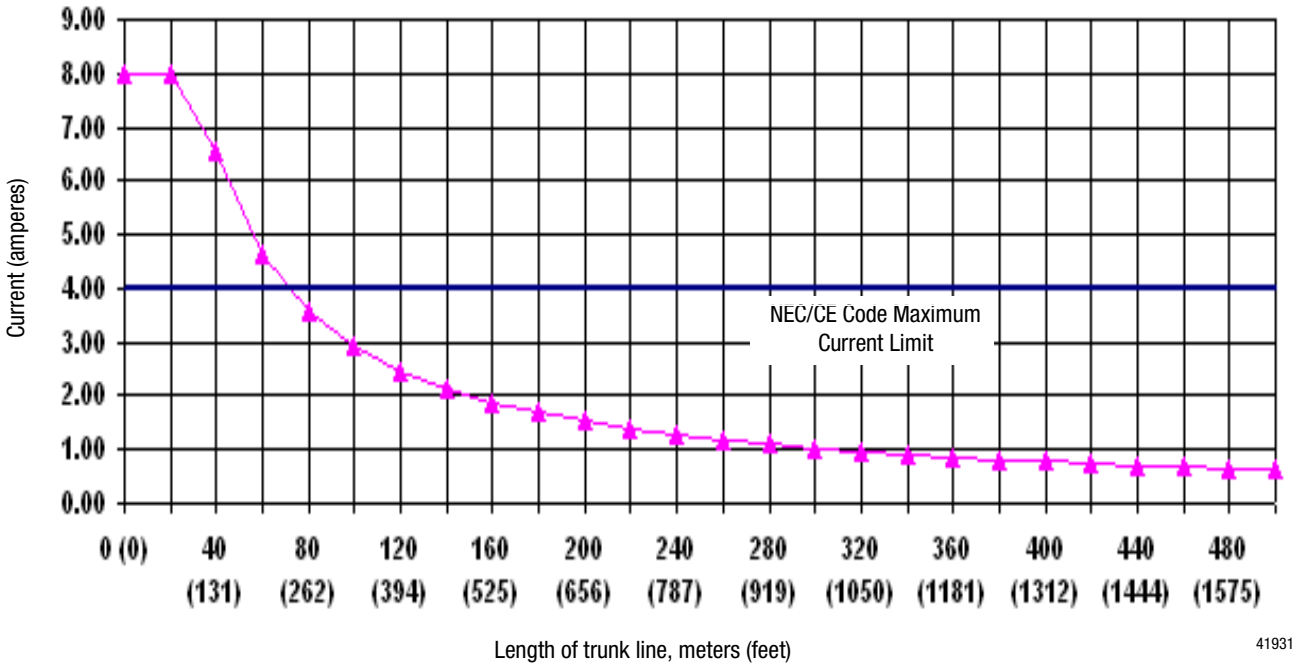
Important: This method may underestimate the capacity of your network by as much as 4 to 1. See the following section to use the full-calculation method if your supply does not fit under the curve.

For this configuration example	Flat cable uses figure	Thick cable uses figure	Thin cable uses figure
One power supply (end-connected)	Figure 4.2	Figure 4.1	Figure 4.7
One power supply (middle-connected)	Figure 4.2	Figure 4.1	Figure 4.7
NEC/CECode current boost configuration (V+ cut)	Figure 4.2	Figure 4.1	Figure 4.7
Two power supplies (end-connected)	Figure 4.6	Figure 4.5	*
Two power supplies (not end-connected)	Figure 4.4	Figure 4.3	*

* You can draw as much as 3A from a thin cable trunk line if the power supply separation is below 70m (230 ft).

Figure 4.1 One Power Supply (End Segment) Round Cable (Thick)

Important: Assumes all nodes are at the opposite end of the cable from the power supply.



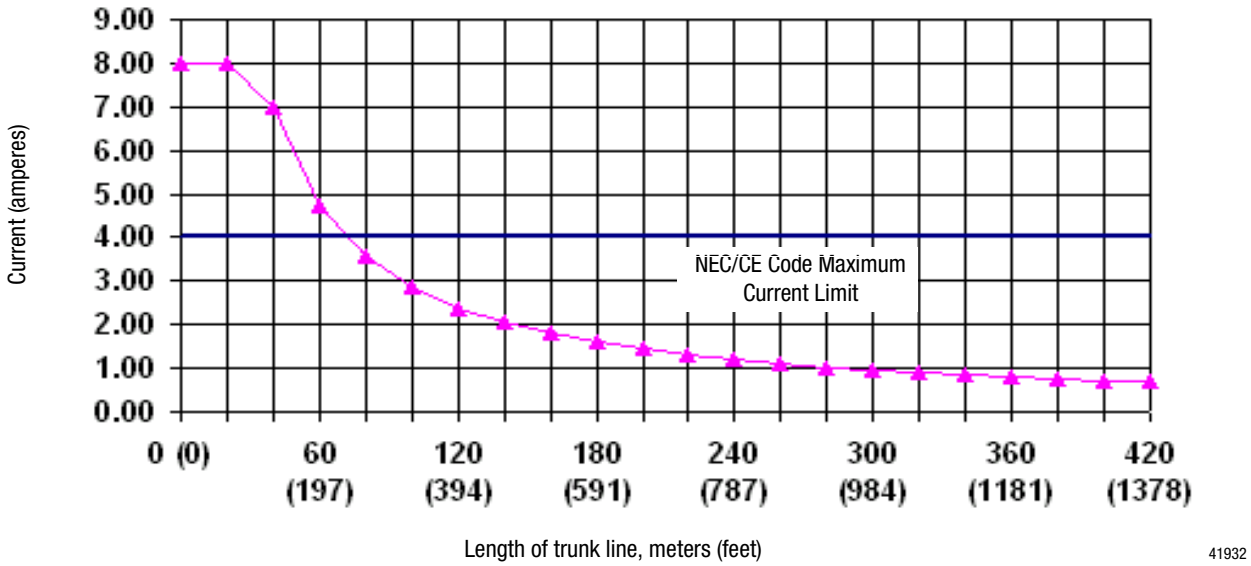
Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*
20 (66)	8.00*
40 (131)	6.53*
60 (197)	4.63*
80 (262)	3.59
100 (328)	2.93
120 (394)	2.47
140 (459)	2.14
160 (525)	1.89
180 (591)	1.69
200 (656)	1.53
220 (722)	1.39

Network Length m (ft)	Maximum Current (A)
240 (787)	1.28
260 (853)	1.19
280 (919)	1.10
300 (984)	1.03
340 (1115)	0.91
360 (1181)	0.86
380 (1247)	0.82
420 (1378)	0.74
440 (1444)	0.71
460 (1509)	0.68
480 (1575)	0.65
500 (1640)	0.63

*Exceeds NEC CL2/CECode 4A limit.

Figure 4.2 One Power Supply (End Segment) KwikLink Cable (Flat)

Important: Assumes all nodes are at the opposite end of the cable from the power supply.

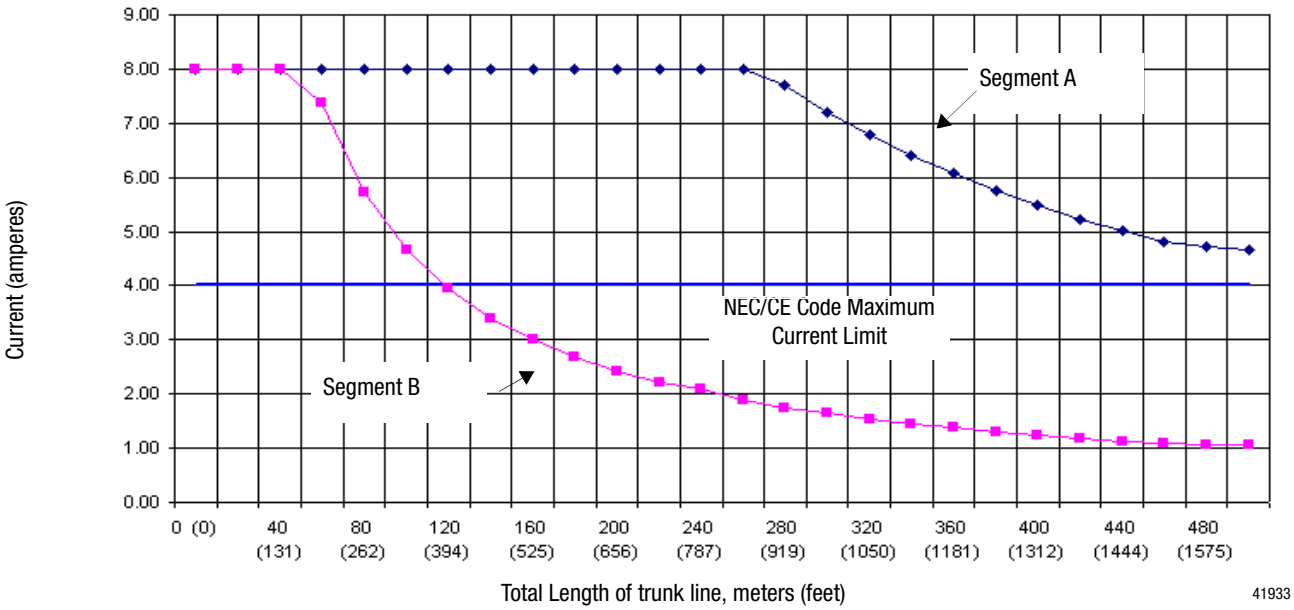


Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*
20 (66)	8.00*
40 (131)	7.01*
60 (197)	4.72*
80 (262)	3.56
100 (328)	2.86
120 (394)	2.39
140 (459)	2.05
160 (525)	1.79
180 (591)	1.60
200 (656)	1.44

Network Length m (ft)	Maximum Current (A)
220 (722)	1.31
240 (787)	1.20
260 (853)	1.11
280 (919)	1.03
300 (984)	0.96
320 (1050)	0.90
340 (1115)	0.85
360 (1181)	0.80
380 (1247)	0.76
400 (1312)	0.72
420 (1378)	0.69

*Exceeds NEC CL2/CECode 4A limit.

Figure 4.3 Two Power Supplies, (one end connected, one middle connected) Two Cable Segments, Round Cable (Thick)



Power Supply A

Network Length m (ft)	Maximum Current (A)	Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*	260 (853)	8.00*
20 (66)	8.00*	280 (919)	7.69*
40 (131)	8.00*	300 (984)	7.21*
60 (197)	8.00*	320 (1050)	6.78*
80 (262)	8.00*	340 (1115)	6.41*
100 (328)	8.00*	360 (1181)	6.07*
120 (394)	8.00*	380 (1247)	5.76*
140 (459)	8.00*	400 (1312)	5.49*
160 (525)	8.00*	420 (1378)	5.24*
180 (591)	8.00*	440 (1444)	5.01*
200 (656)	8.00*	460 (1509)	4.80*
220 (722)	8.00*	480 (1575)	4.73*
240 (787)	8.00*	500 (1640)	4.66*

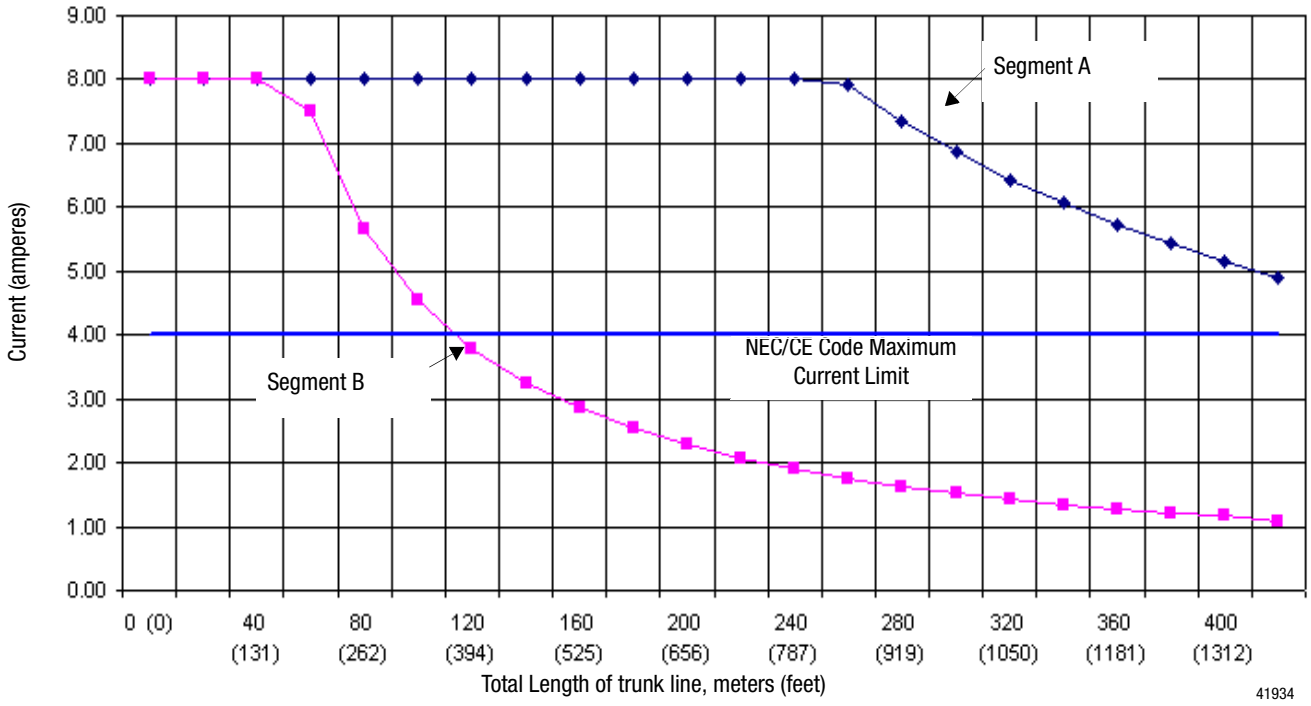
*Exceeds NEC CL2/CECode 4A limit.

Power Supply B

Network Length m (ft)	Maximum Current (A)	Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*	260 (853)	1.89
20 (66)	8.00*	280 (919)	1.76
40 (131)	8.00*	300 (984)	1.64
60 (197)	7.38*	320 (1050)	1.54
80 (262)	5.71*	340 (984)	1.46
100 (328)	4.66*	360 (1050)	1.38
120 (394)	3.94	380 (1247)	1.31
140 (459)	3.40	400 (1312)	1.24
160 (525)	3.00	420 (1378)	1.18
180 (591)	2.68	440 (1444)	1.13
200 (656)	2.43	460 (1509)	1.08
220 (722)	2.22	480 (1575)	1.07
240 (787)	2.08	500 (1640)	1.05

*Exceeds NEC CL2/CECode 4A limit.

Figure 4.4 Two Power Supplies, (one end connected, one middle connected) Two Cable Segments, KwikLink Cable (Flat)



Segment Supply A

Network Length m (ft)	Maximum Current (A)	Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*	220 (722)	8.00*
20 (66)	8.00*	240 (787)	8.00*
40 (131)	8.00*	260 (853)	7.91*
60 (197)	8.00*	280 (919)	7.35*
80 (262)	8.00*	300 (984)	6.86*
100 (328)	8.00*	320 (1050)	6.43*
120 (394)	8.00*	340 (1115)	6.06*
140 (459)	8.00*	360 (1181)	5.72*
160 (525)	8.00*	380 (1247)	5.43*
180 (591)	8.00*	400 (1312)	5.16*
200 (656)	8.00*	420 (1378)	4.91*

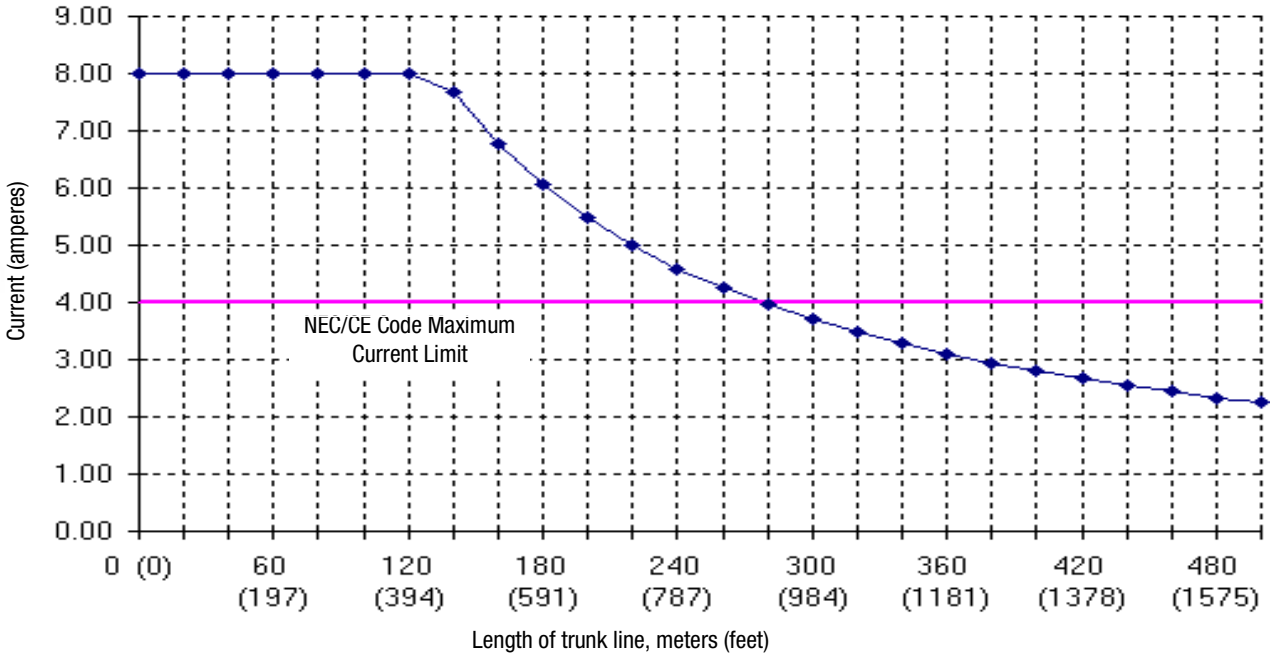
*Exceeds NEC CL2/CECode 4A limit.

Segment Supply B

Network Length m (ft)	Maximum Current (A)	Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*	220 (722)	2.08
20 (66)	8.00*	240 (787)	1.91
40 (131)	8.00*	260 (853)	1.76
60 (197)	7.52*	280 (919)	1.64
80 (262)	5.67*	300 (984)	1.53
100 (328)	4.55*	320 (1050)	1.43
120 (394)	3.80	340 (984)	1.35
140 (459)	3.26	360 (1050)	1.28
160 (525)	2.86	380 (1247)	1.21
180 (591)	2.54	400 (1312)	1.19
200 (656)	2.29	420 (1378)	1.09

*Exceeds NEC CL2/CECode 4A limit.

Figure 4.5 Two End-Connected Power Supplies, Round Cable (Thick)

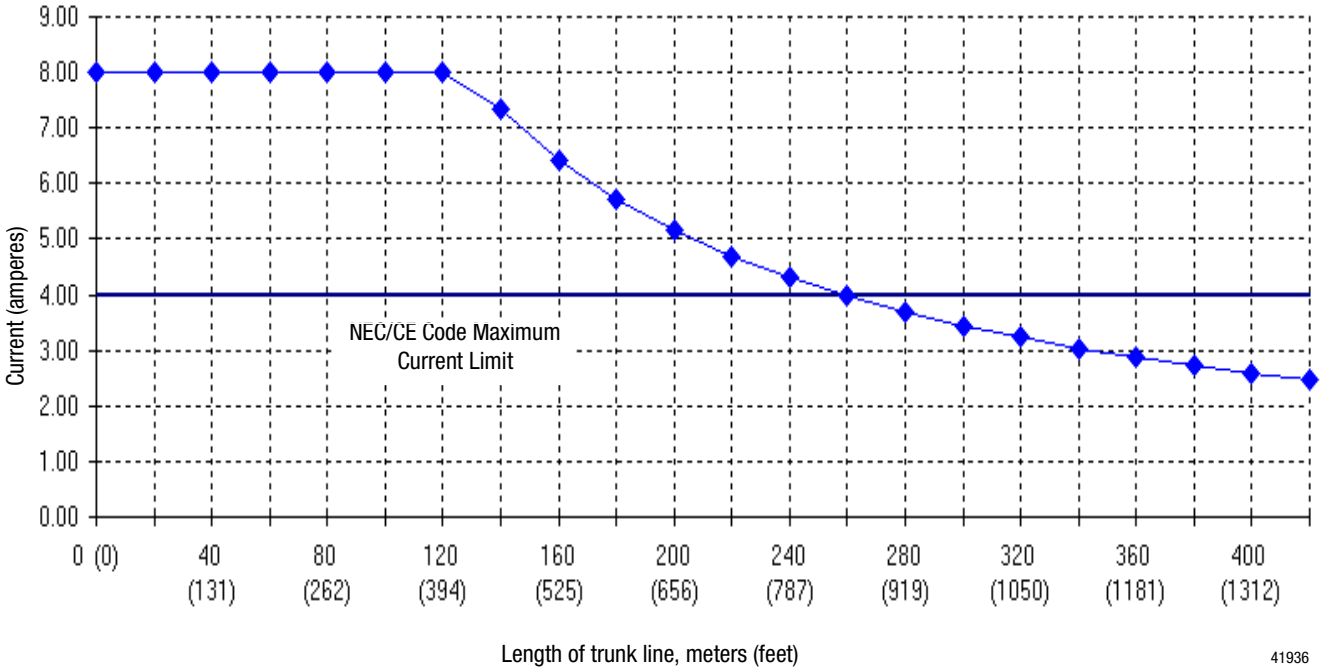


Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*
20 (66)	8.00*
40 (131)	8.00*
60 (197)	8.00*
80 (262)	8.00*
100 (328)	8.00*
120 (394)	8.00*
140 (459)	7.68*
160 (525)	6.77*
180 (591)	6.05*
200 (656)	5.47*
220 (722)	4.99*
240 (787)	4.59*

Network Length m (ft)	Maximum Current (A)
260 (853)	4.25*
280 (919)	3.96
300 (984)	3.70
320 (1050)	3.48
340 (1115)	3.28
360 (1181)	3.10
380 (1247)	2.94
400 (1312)	2.79
420 (1378)	2.66
440 (1444)	2.55
460 (1509)	2.44
480 (1575)	2.34
500 (1640)	2.25

*Exceeds NEC CL2/CECode 4A limit.

Figure 4.6 Two End-Connected Power Supplies, KwikLink Cable (Flat)

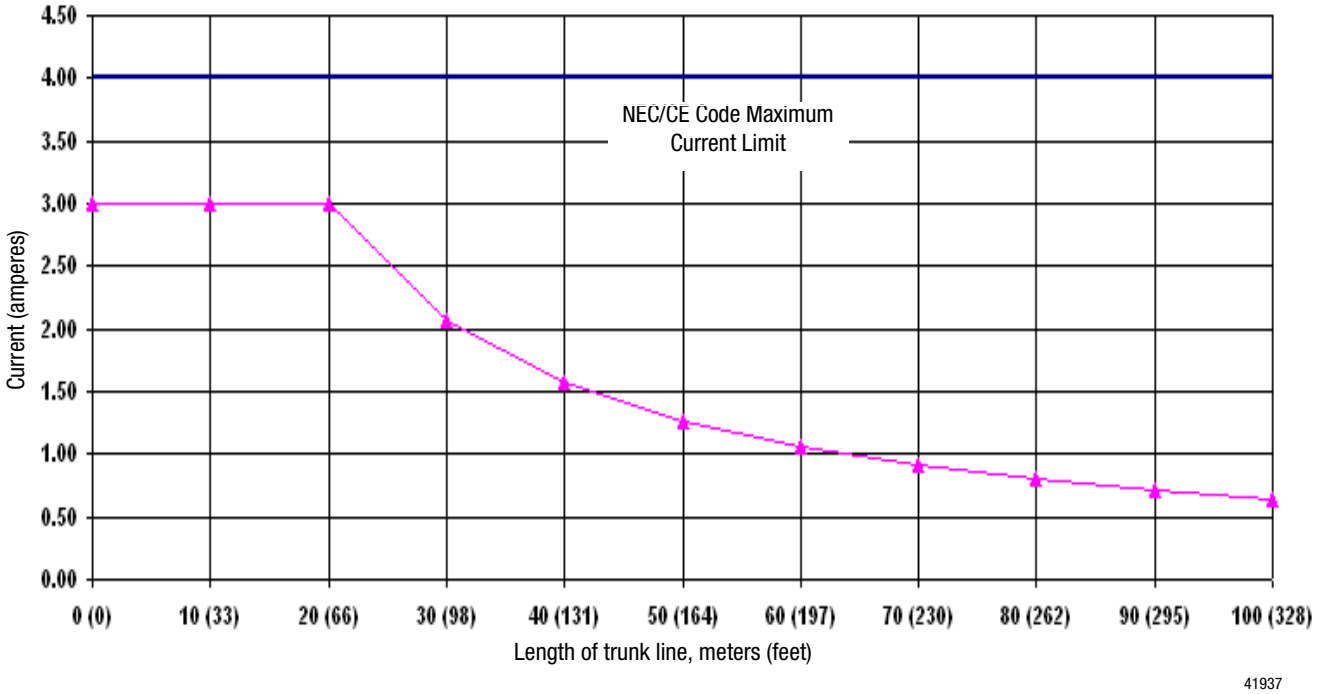


Network Length m (ft)	Maximum Current (A)
0 (0)	8.00*
20 (66)	8.00*
40 (131)	8.00*
60 (197)	8.00*
80 (262)	8.00*
100 (328)	8.00*
120 (394)	8.00*
140 (459)	7.35*
160 (525)	6.43*
180 (591)	5.72*
200 (656)	5.16*

Network Length m (ft)	Maximum Current (A)
220 (722)	4.69*
240 (787)	4.30*
260 (853)	3.97
280 (919)	3.69
300 (984)	3.44
320 (1050)	3.23
340 (1115)	3.04
360 (1181)	2.87
380 (1247)	2.72
400 (1312)	2.59
420 (1378)	2.46

*Exceeds NEC CL2/CECode 4A limit.

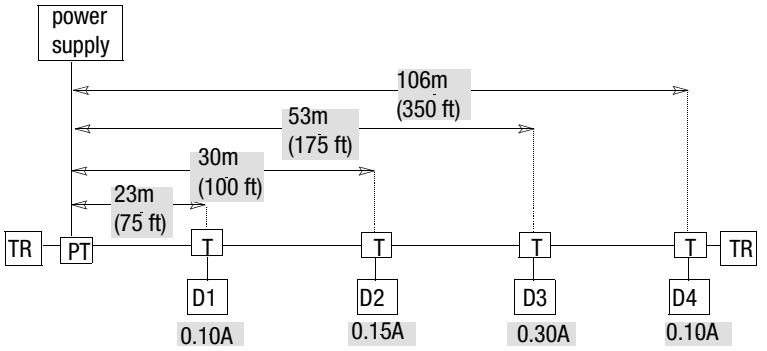
Figure 4.7 One Power Supply (End Segment) Round Cable (Thin)



Network Length m (ft)	Maximum Current (A)
0 (0)	3.00
10 (33)	3.00
20 (66)	3.00
30 (98)	2.06
40 (131)	1.57
50 (164)	1.26
60 (197)	1.06
70 (230)	0.91
80 (262)	0.80
90 (295)	0.71
100 (328)	0.64

One Power Supply (End-Connected)

The following example uses the look-up method to determine the configuration for one end-connected power supply. One end-connected power supply provides as much as 8A near the power supply.



TR = terminating resistor T = T-Port tap
PT = PowerTap tap D = device

41833

1. Determine the total length of the network.

– **106m**

2. Add each device's current together to find the total current.

– 0.10+0.15+0.30+0.10

Important: Make sure that the required power is less than the rating of the power supply. You may need to derate the supply if it is in an enclosure.

3. Find the value next largest to the network length using Figure 4.1 on page Page 4-4 to determine the maximum current allowed for the system (approximately).

– **120m (2.47A)= 0.65A**

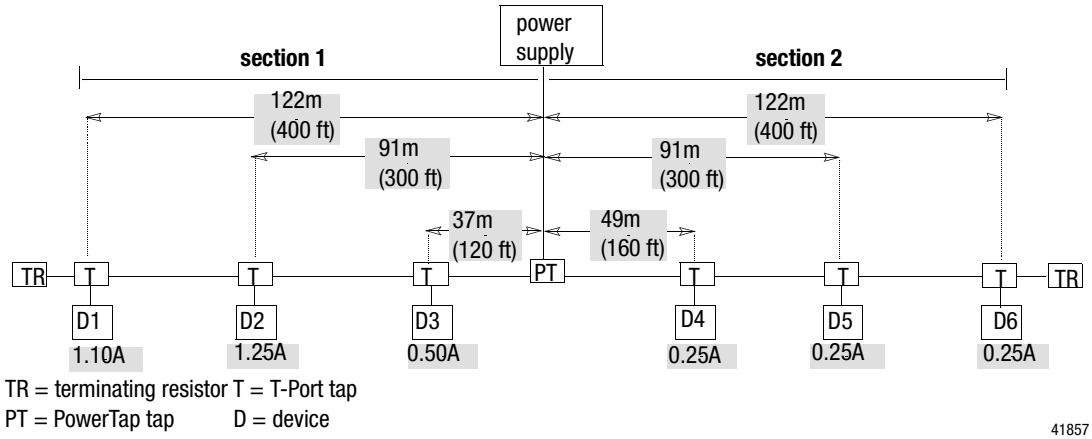
Results ⇨ Since the total current does not exceed the maximum allowable current, the system will operate properly (0.65A ≤ 2.47A).

Important: If your application doesn't fit ''under the curve", you may either:

- do the full-calculation method described later in this chapter
- move the power supply to somewhere in the middle of the cable system and reevaluate per the following section

One Power Supply (Middle-Connected)

The following example uses the look-up method to determine the configuration for one middle-connected power supply. One middle-connected power supply provides the maximum current capability for a single supply.



1. Add each device's current together in section 1.

- **1.10+1.25+0.50 = *2.85A***

2. Add each device's current together in section 2.

- **0.25+0.25+0.25 = *0.75A***

3. Find the value next largest to each section's length to determine the maximum current allowed for each section (approximately).

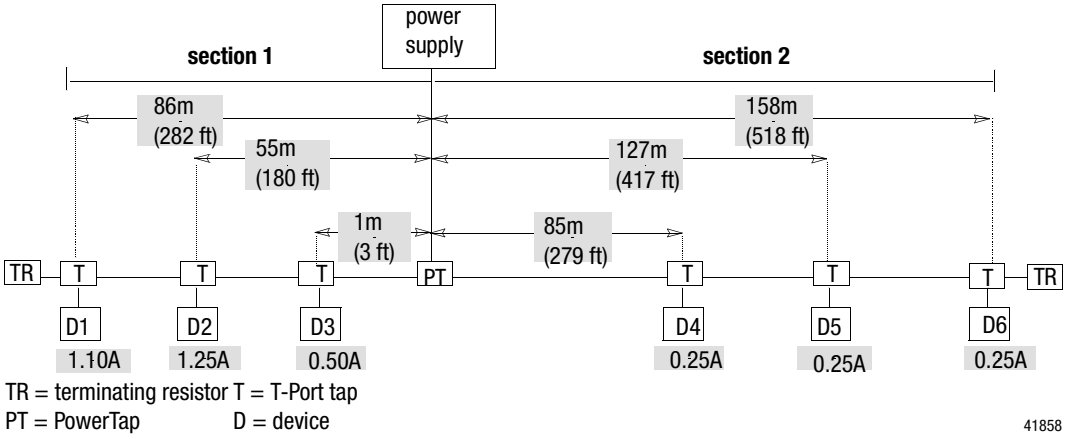
- **Section 1 = *140m (2.14A)***
- **Section 2 = *140m (2.14A)***

Important: Section 1 + Section 2 < 3.6A. This is ≤ 4A for NEC/CECode compliance.

Results ⇨ Section 1 is overloaded because the total current exceeds the maximum current (2.85A ≥ 2.14A).

Section 2 is operational since the total current does not exceed the maximum current (0.75A ≤ 2.14A).

Balance the system by moving the power supply toward the overloaded section (section 1). Then recalculate each section.



4. Add each device's current together in section 1.

– **1.10+1.25+0.50 = *2.85A***

5. Add each device's current together in section 2.

– **0.25+0.25+0.25 = *0.75A***

6. Find the value next largest to each section's length using Figure 1 on page Page 4-4 to determine the maximum current allowed for each section (approximately).

– **Section 1 = *100m (2.93A)***

– **Section 2 = *160m (1.89A)***

Important: Section 1+ Section 2 < 3.6A. This is ≤ 4A for NEC/CECode compliance. **However, if due to derating of the power supply, you had to use over a 4A power supply, you would exceed the NEC/CECode maximum allowable current.**

Results

Section 1 is operational since the total current does not exceed the maximum current (2.85A ≤ 2.93A).

Section 2 is operational since the total current does not exceed the maximum current (0.75A ≤ 1.89A).

Adjusting the Configuration

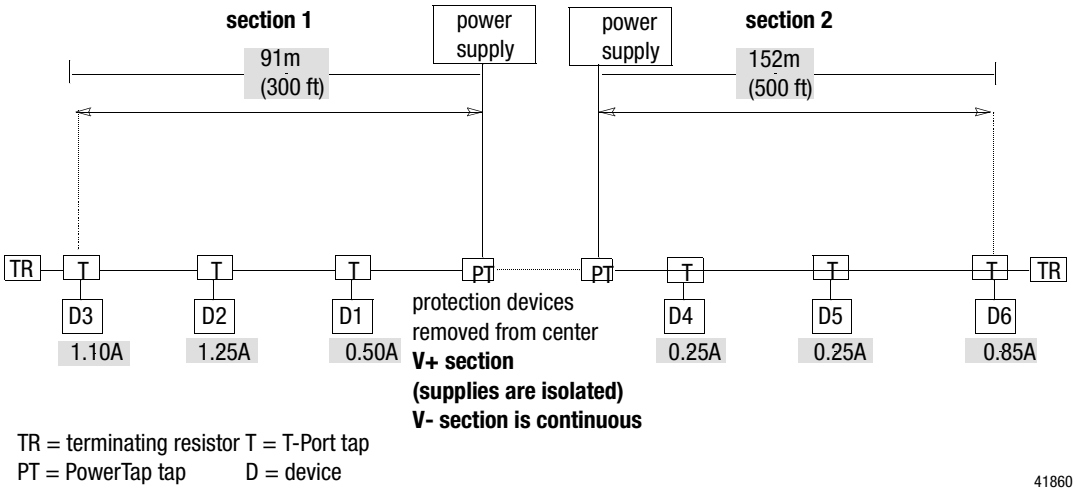
To make the system operational, you can:

- move the power supply in the direction of the overloaded section
- move higher current loads as close to the supply as possible
- move devices from the overloaded section to another section
- shorten the overall length of the cable system

- perform the full-calculation method for the segment described later in this chapter for the non-operational section
- add a second power supply to the cable system (do this as a last resort) as shown in the following three examples

NEC/CECode Current Boost Configuration

If the national or local codes limit the maximum rating of a power supply, use the following configuration to replace a single, higher current power supply.

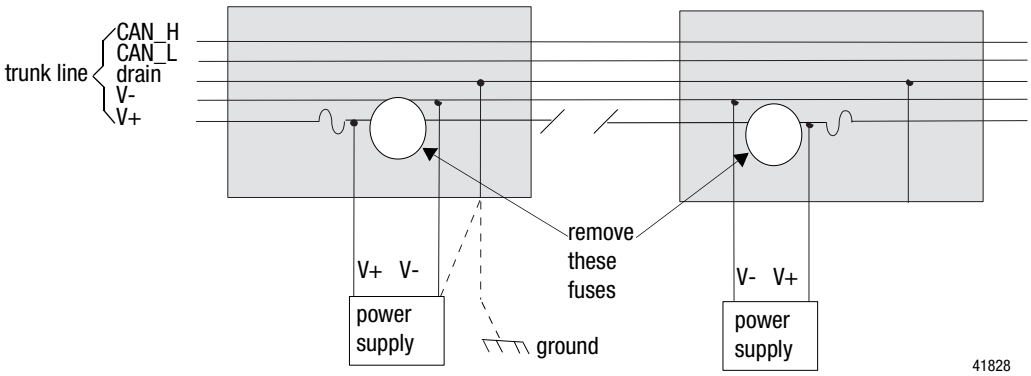


This configuration effectively doubles the available current. It has the following characteristics:

- no loads are allowed between the PowerTap taps
- fuses between the two PowerTap taps must be removed to segment the V+ conductor in the trunk line between the taps
  - also cut V+ (red) flush with cable jacket

These are the PowerTap tap modifications.

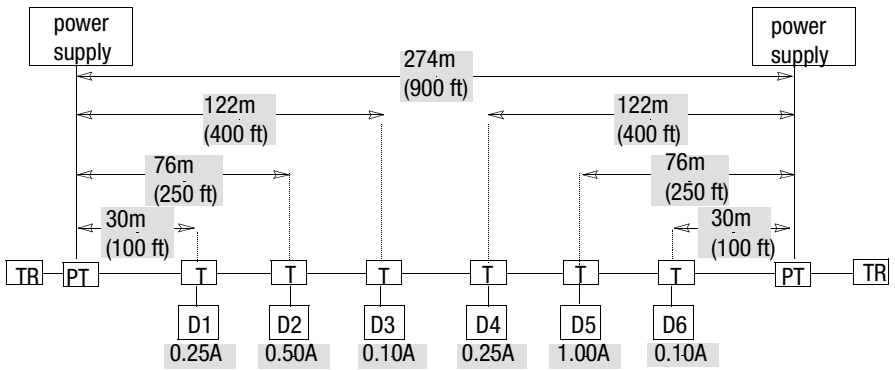
Wire Color	Wire identity	Use
white	CAN_H	signal
blue	CAN_L	signal
bare	drain	shield
black	V-	power
red	V+	power



- essentially two independent segments, each of which is a “one power supply end-connected system”
  - use Figure 4.5 on page 4-8 for each segment
- each power supply can be rated up to 4A and still meet NEC/CECode Class 2 current restrictions

Two Power Supplies (End-Connected) in Parallel with No V+ Break

The following example uses the look-up method to determine the configuration for two end-connected power supplies. You must use diodes at the power taps to prevent back-feeding of the power supplies. Check your national and local codes for any restrictions on the use of parallel power supplies. The NEC/CECode requires that the power supplies must be listed for parallel operation.



TR = terminating resistor T = T-Port tap
PT = PowerTap D = device

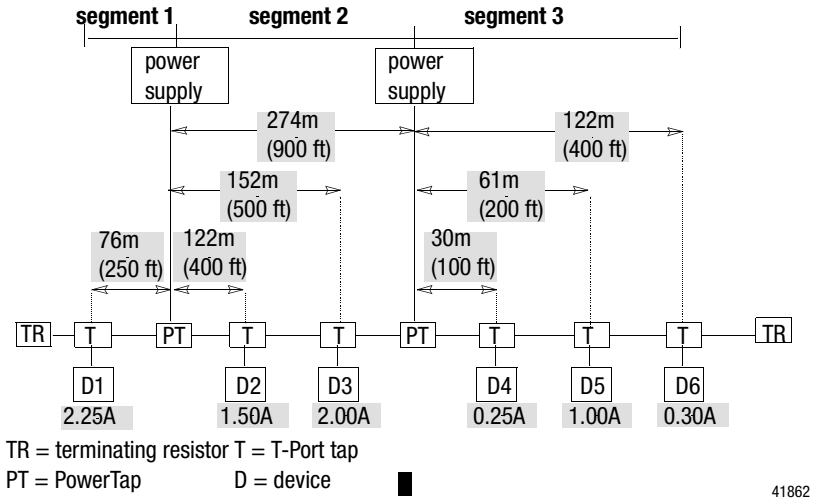
41861

1. Determine the total length of the network.
   - ***274m***
2. Add each device’s current together to find the total current.
   - **0.25+0.50+0.10+0.25+1.00+0.10 = *2.20A***
3. Find the value next largest to each section’s length using Figure 4.5 on page 4-8 to determine the maximum current allowed for each section (approximately).
   - **280m (3.96A)**

Results ⇨ Since the total current does not exceed the maximum current, the system will operate properly (2.20A ≤ 3.96A).

Two Power Supplies (Not End-Connected) in Parallel with No V+ Break

The following example uses the look-up method to determine the configuration for two power supplies that are not end-connected. This configuration provides the most power to the cable system. You must use diodes at the power taps to prevent back-feeding of the power supplies. Check your national and local codes for any restrictions on the use of parallel power supplies.



1. Determine the trunk line length of one end section (for this example we will use section 3).

   – **122m**

2. Add each device's current together in section 3.

   – **0.25+1.00+0.30 = *1.55A***

3. Find the value next largest to the length of section 3 using Figure 4.3 on page 4-6 to determine the maximum current allowed (approximately).

   – **140m (3.40A)**

Important: If the total current in the section exceeds the maximum current, move the power supply closer to the end and repeat steps 1-3 until the total current in the section is less than the maximum allowable current.

Results ⇨ Since the total current does not exceed the maximum current, section 3 will operate properly (1.55A ≤ 3.40A).
Loading is 46% (1.55/3.40).

4. Determine the trunk line length of the other end section (section 1).

   – **76m**

5. Add each device's current together in section 1.

   – **2.25A**

6. Find the value next largest to the length of section 1 using Figure 4.1 on page 4-4 to determine the maximum current allowed (approximately).

   – **80m (3.59A)**

Important: If the total current in the section exceeds the maximum current, move the power supply closer to the end and repeat steps 4-6 until the total current in the section is less than the maximum allowable current.

Results ⇨ Since the total current does not exceed the maximum current, section 1 will operate properly (2.25A ≤ 3.59A).
Loading is 63% (2.25/3.59).

7. Determine the length of the middle section (section 2).

   – **274m**

8. Add each device's current together in section 2.

   – **1.50+2.00 = 3.50A**

9. Find the value next largest to the length of section 2 using Figure 4.3 on page 4-6 to determine the maximum current allowed (approximately).

   – **280m (7.69A)**

Important: If the total current in the section exceeds the maximum current, move the power supplies closer together and repeat steps 7-9 until the total current in the section is less than the maximum allowable current.

Results ⇨ Since the total current does not exceed the maximum allowable current, section 2 will operate properly (3.50A ≤ 7.69A).
Loading is 46% (3.50/7.69).

If the middle section is still overloaded after you move the power supplies closer together, add a third power supply. Then recalculate each segment.

Important: Section 1 + Section 2 + Section 3 = 7.3A. This is $\underline{>}$ 4A and does not comply with the NEC/CECode for Class 2 installations.

Important: To determine spare capacity for future expansion, subtract the actual current from the maximum allowable current. To determine the percentage loading for each segment, divide the maximum allowable current into the actual current.

Segment	Maximum Current - Actual Current =	Spare Capacity	% Loading/ Segment
1	2.85A - 2.25A=	0.60A	79% (2.25A/2.85A)
2	3.83A - 3.50A=	0.33A	91% (3.50A/3.83A)
3	1.70A - 1.55A=	0.15A	91% (1.55A/1.70A)

Use the Full-calculation Method

Use the full-calculation method if your initial evaluation indicates that one section is overloaded or if the requirements of your configuration cannot be met by using the look-up method.

Important: Before constructing the cable system, repeat all calculations to avoid errors.

Using the Equation

A supply that is not end-connected creates two sections of trunk line.

Evaluate each section independently.

$$\text{SUM } \{[(L_n \times (R_c)) + (N_t \times (0.005))] \times I_n\} \leq 4.65V$$

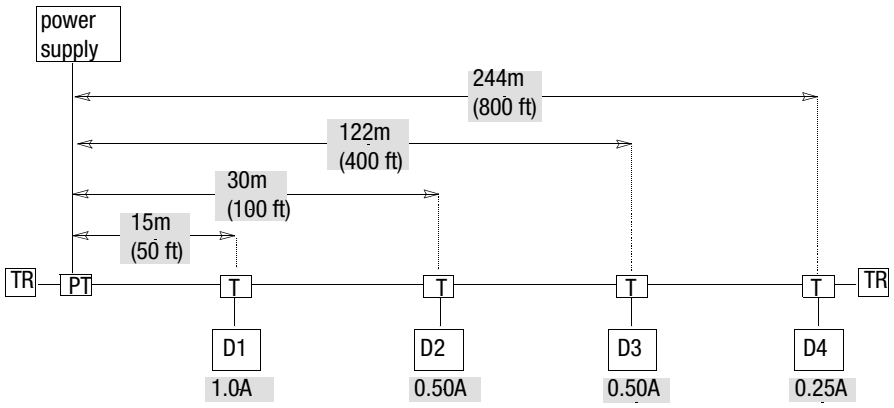
Term	Definition
L_n	L = The distance (m or ft) between the device and the power supply, excluding the drop line distance. n = The number of a device being evaluated, starting with one for the device closest to the power supply and increasing by one for the next device. The equation sums the calculated drop for each device and compares it to 4.65V.
R_c	Thick cable Metric 0.015 Ω/m English 0.0045 Ω/ft Thin cable Metric 0.069 Ω/m English 0.021 Ω/ft Flat Cable Metric 0.019 Ω/m English 0.0058 Ω/ft
N_t	The number of taps between the device being evaluated and the power supply. For example: • when a device is the first one closest to the power supply, this number is 1 • when a device has one device between it and the power supply, this number is 2 • when 10 devices exist between the evaluated device and the power supply, this number is 11. For devices attached to a DeviceBox tap or DevicePort tap, treat the tap as one tap. The currents for all devices attached to one of these taps should be summed and used with the equation only once.
(0.005)	The nominal-contact resistance used for every connection to the trunk line.
I_n	I = The current drawn from the cable system by the device.For currents within 90% of the maximum, use the nominal device current. Otherwise, use the maximum rated current of the device. For DeviceBox taps or DevicePort taps, sum the currents of all the attached devices, and count the tap as one tap. n = The number of a device being evaluated, starting with one for the device closest to the power supply and increasing by one for the next device.
4.65V	The maximum voltage drop allowed on the DeviceNet trunk line. This is the total cable system voltage drop of 5.00V minus 0.35V reserved for drop line voltage drop.

One Power Supply (End-Connected)

Example of Thick Cable

The following example uses the full calculation method to determine the configuration for one end-connected power supply on a thick cable trunk line.

- Device 1 and Device 2 cause the same voltage drop but Device 2 is twice as far from the power supply and draws half as much current.
- Device 4 draws the least amount of current but it is furthest from the power supply and causes the greatest incremental voltage drop.



TR = terminating resistor T = T-Port tap
PT = PowerTap D = device

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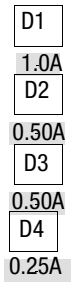
1. Find the voltages for each device using the equation for thick cable.

SUM {[(L_n x (0.0045)) + (N_t x (0.005))] x I_n} ≤ 4.65V.



A.[(**50** x (0.0045)) + (**1** x (0.005))] x **1.00** = ***0.23V***

B.[(**100** x (0.0045)) + (**2** x (0.005))] x **0.50** = ***0.23V***

C.[(**400** x (0.0045)) + (**3** x (0.005))] x **0.50** = ***0.91V***

D.[(**800** x (0.0045)) + (**4** x (0.005))] x **0.25** = ***0.91V***

1. Add each device's voltage together to find the total voltage.

0.23V + 0.23V + 0.91V + 0.91V = ***2.28V***

Results ⇨ Since the total voltage does not exceed 4.65V, the system will operate properly (2.28V ≤ 4.65V).

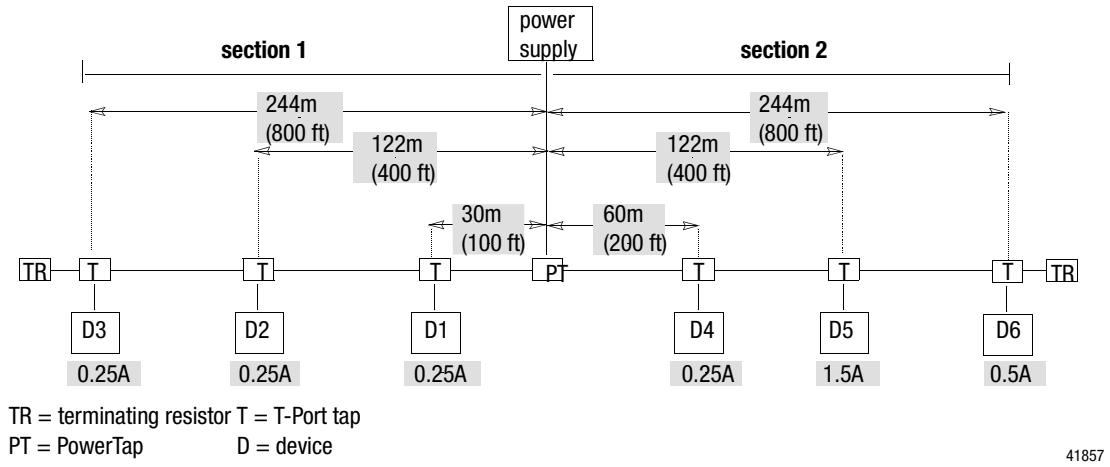
The percent loading is found by dividing the total voltage by 4.65V.

%Loading = 2.28/4.65 = ***49%***

One Power Supply (Middle-Connected)

Example of Thick Cable

This example is used to check loading on both sides of a middle-connected supply on a thick cable trunk line. Keep the loads, especially the higher ones, close to the power supply. If the device location is fixed, put the power supply in the center of the highest current concentration.



TR = terminating resistor T = T-Port tap
PT = PowerTap D = device

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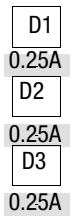
According to the look-up method, section 1 is operational while section 2 is overloaded.

Value of	Section 1	Section 2
Total maximum current	1.25A (approximately)	1.25A (approximately)
Total current required	0.75A	2.25A

1. Find the voltages for each device in section 1 using the equation for thick cable.

SUM {[(L_n x (0.0045)) + (N_t x (0.005))] x I_n} ≤ 4.65V.



A.[(**100** x (0.0045)) + (**1** x (0.005))] x **0.25** = ***0.12V***

B.[(**400** x (0.0045)) + (**2** x (0.005))] x **0.25** = ***0.45V***

C.[(**800** x (0.0045)) + (**3** x (0.005))] x **0.25** = ***0.90V***

2. Add each device's voltage together to find the total voltage for section 1.

0.12V + 0.45V + 0.90V = ***1.47V***

3. Find the voltages for each device in section 2 using the equation for thick cable.

SUM {[(L_n x (0.0045)) + (N_t x (0.005))] x I_n} ≤ 4.65V.

D4
0.25A
D5
1.5A
D6
0.5A

A.[(**200** x (0.0045)) + (**1** x (0.005))] x **0.25** = ***0.23V***

B.[(**400** x (0.0045)) + (**2** x (0.005))] x **1.5** = ***2.72V***

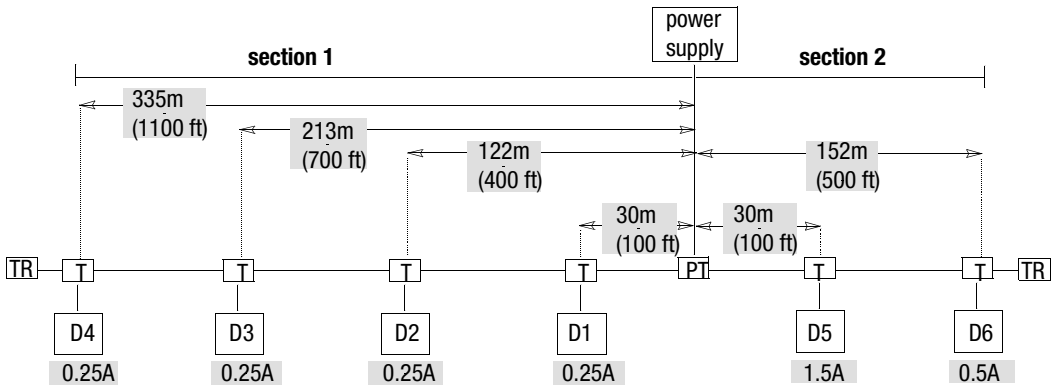
C.[(**800** x (0.0045)) + (**3** x (0.005))] x **0.5** = ***1.81V***

4. Add each device's voltage together to find the total voltage for section 2.

0.23 + 2.72 + 1.81 = ***4.76V***

Results Since the total voltage in section 2 exceeds 4.65V, the system will not operate properly (4.76V > 4.65V).

Attempt to correct this overload by moving the power supply 91m (300ft) toward the overloaded section. Now there are four devices in section 1 and two devices in section 2. Once you've moved the power supply, try the calculations again.



TR = terminating resistor T = T-Port tap
PT = PowerTap D = device

41859

1. Find the voltages for each device in section 1 using the equation for thick cable.

SUM {[(L_n x (0.0045)) + (N_t x (0.005))] x I_n} ≤ 4.65V.

D1
0.25A
D2
0.25A
D3
0.25A
D4
0.25A

A.[(**100** x (0.0045)) + (**1** x (0.005))] x **0.25** = ***0.11V***

B.[(**400** x (0.0045)) + (**2** x (0.005))] x **0.25** = ***0.45V***

C.[(**700** x (0.0045)) + (**3** x (0.005))] x **0.25** = ***0.79V***

D.[(**1100** x (0.0045)) + (**4** x (0.005))] x **0.25** = ***1.24V***

2. Add each device's voltage together to find the total voltage for section 1.

0.11 + 0.45 + 0.79 + 1.24= ***2.59V***

3. Find the voltages for each device in section 2 using the equation for thick cable.

SUM {[(L_n x (0.0045)) + (N_t x (0.005))] x I_n} ≤ 4.65V.

D5
1.5A
D6
0.5A

A.[(**100** x (0.0045)) + (**1** x (0.005))] x **1.5** = ***0.68V***

B.[(**500** x (0.0045)) + (**2** x (0.005))] x **0.5** = ***1.13V***

4. Add each device's voltage together to find the total voltage for section 2.

0.68 + 1.13 = ***1.81V***

Results

Since the total voltage does not exceed 4.65V in either section, the system will operate properly - section 1 (2.59V ≤ 4.65V)
section 2 (1.81V ≤ 4.65V).

The percent loading is found by dividing the total voltage by 4.65V.

Section 1% Loading = 2.59/4.65 = ***56%***
Section 2% Loading = 1.81/4.65 = **39%**

Understanding Select NEC Topics

What's in This Appendix

Be aware that the following topics from the National Electrical Code (NEC) 725 (revision 1999) impact the configuration and installation of DeviceNet systems in the United States. There also may be additional NEC sections and local codes that you must meet. Other codes exist outside of the United States that may also affect your installation.

Specifying Article 725 Topics

Round (Thick & Thin) and Class 2 Flat Media

- power limitations of Class 2 circuits
  - The power source for Class 2 circuits must be either inherently limited, thus requiring no overcurrent protection, or limited by a combination of a power source and overcurrent protection.
- marking
  - Class 2 power supplies must be durably marked where plainly visible to indicate the class of the supply and its electrical ratings.
- interconnection of power supplies
  - Class 2 power supplies must not be paralleled or otherwise interconnected unless listed for such applications.

Class 1 Flat Media

- power limitations of Class 1 circuits
  - The overcurrent protection shall not exceed 10 amperes per NEC article 725-23.
  - Consult the product manufacturer to determine if the device is suitable for installation with a Class 1 power source.

Powering Output Devices

Wide Available Voltage Range

You can power some output devices on the DeviceNet network. The application must allow the voltage to remain within the DeviceNet specification limits of 11-25V dc. Most actuators need to be powered by a separate power supply. They usually require more power than is practically available from DeviceNet. Also, the large voltage variation of 11-25V that DeviceNet allows is typically beyond the range that most available actuators or output devices can safely operate over.

You can use DeviceNet power to operate output devices such as hydraulic and pneumatic solenoid valves, pilot and stack lights, and motor starter coils with the following caution:

ATTENTION: Do not let DeviceNet voltage at the relevant node exceed the output device's acceptable voltage range. Output devices rated 24V dc rarely are specified to operate below 19.2V dc or -20% of their 24V dc rating. Many only operate down to 20.4V dc or -15% of the rated voltage. This means that the DeviceNet network design must not allow the available voltage to drop below 19.2 volts, for example, instead of the 11 volts that the DeviceNet specification allows. This higher lower voltage limit which is within the DeviceNet specification will actually restrict the distance of the DeviceNet network from what would be possible if actuators were not utilizing the DeviceNet power

Important: Design your network to make sure that sufficient voltage is available to operate the output device wherever it is installed. This is especially important when it is connected at the farthest location from the power supply.

The DeviceNet common mode drop voltage specification limit of 10 volts, 5 volts in each power supply V+ and V- conductor, will never be a concern. This is because in the design process we start with a 24V dc power supply and allow for the 4% stack-up tolerance which leaves 23V dc to work with. From here we consider the output device's minimum required operating voltage of 19.2 volts. This gives 23V dc-19.2V dc = 3.8V dc for the common mode voltage or 1.9V dc in each conductor. This is far more restrictive than the 5 volts of the DeviceNet specification and will result in shorter allowable distances for the installation.

Noise or Transient Protection

The typical actuators used in DeviceNet control systems utilize inductive coils that generate transients when de-energized. You must use appropriate protection to suppress transients during coil de-energization. Add a diode across the inductive coil to suppress transients on the actuator's dc coils. Use a MOV varistor module suppressor for a 24V dc coil if this added drop out time with the diode is unacceptable. This varistor module must clamp the transient voltage across the coil at 55 volts to prevent the output contact from arcing on switch separation.

Typical actuators used in DeviceNet control systems use inductive coils and limit current transients on energization by their inherent L/R time constant. Any transients due to contact bounce on energization will be suppressed by the transient protection utilized for coil de-energization.

ATTENTION: Do not use DeviceNet power on dc coil actuators that use economizing coils to operate. They have high inrush currents.

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